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Oral Health Status among Type 2 Diabetes Mellitus Patients Attending Governmental Primary Health Centers at Gaza Governorates

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Dedication

I dedicate this dissertation to my extraordinary mother, father for being the greatest source of inspiration, continuous support, kind words, and encouragement.

To my sisters and brothers for giving me the faith and passion to complete my dissertation.

To the light of my eyes... my kids Yazan, Leen, Taym and Selena

To each and every one who helped me and believed in me to finalize this thesis.

I dedicate this thesis to you and from the bottom of my heart thank you and much love.

Aesha Mohammed Joma' Fetaiha

Declaration

I certify that this thesis submitted for the degree of master is the result of my own research, except where otherwise acknowledged, and that this thesis or any of its parts has not been submitted for higher degree to any other university or institution.

Signed:

Aesha Mohammed Joma' Fetaiha

Date: 30/7/2022

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Yours faithfully

Aesha Mohammed Joma' Fetaiha

Abstract

Background / Objective**: Diabetes mellitus disease is a main public health problem which badly affects oral health and overall quality of life. This thesis aimed to examine oral health problems and needs of patients with type 2 diabetes mellitus attending governmental primary health centers in Gaza Governorates.* ***Methods: *A mixed method convergent parallel design was employed in May 2021. A cross-sectional study was applied to 376 patients with type 2 diabetes mellitus selected through systematic random sampling from 5 randomly selected governmental primary health centers. Moreover, 13 patients were purposefully recruited for interviews in the qualitative part. The World Health Organization Decayed ,Missing and Filling Tooth Index, semi-structured questionnaire and interview guide were used to collect data accordingly. Descriptive, analytical and thematic analysis were applied for the quantitative and qualitative research, respectively.* ***Results:*** *Most patients (64%) see themselves susceptible to oral complications, and 67.8% perceived high severity of these complications. Nearly three quarter (73.2%) believe that there are benefits from oral health practices, and 56.2% perceived many barriers to oral health practices. Nearly half of participants (57.6%) are aware about oral complications resulted from type 2 diabetes mellitus, and 42% committed to oral hygiene practices. The mean of Decayed ,Missing and Filling Tooth Index is 13.18±6.39 and the mean teeth with loss of attachment is 1.88±0.76. Majority of participants have no periodontitis (160/376; 42.6%). In return, 8.5%, 21.5% and 27.4 % presents with severe (32/376), moderate (81/376) and mild periodontitis (103/376), respectively. Gingival bleeding and loss of attachment are higher among males ,ex-smoker and who live in the southern part of Gaza strip. The mean of Decayed ,Missing and Filling Tooth Index, gingival bleeding, and loss of attachment is higher among patients having type 2 diabetes mellitus for more than 10 years and with history of chronic diseases, whereas, the mean of pocket is higher among patients having uncontrolled diabetes mellitus and type 2 diabetes mellitus less than 10 years Decayed ,Missing and Filling Tooth Index and loss of attachment is higher among patients with history of chronic diseases.* ***Conclusion:*** *Patients with type 2 diabetes mellitus suffer from many oral health problems especially dental caries, periodontitis and loss of attachment. Furthermore, there is a need for establishing health education campaigns at governmental, non-governmental settings and within community to sensitize diabetic patients about importance of controlling glycemic level on promoting healthy oral cavity and vice versa.*

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List of Abbreviations

ADA	American Diabetes Association
AGE	Advanced Glycation End products
BMS	Burning Mouth Syndrome
DM	Diabetes Mellitus
DMFT	Decayed, Missed and Filled Teeth
CAL	Clinical Attachment Loss
PPD	Proboing Pocket Depth
BOP	Bleeding On Probing
CEJ	Cemento-enamel junction
CPI	Community Periodontal Index
GDP	Gross Domestic Product
GS	Gaza Strip
HbA1c	Glycated Hemoglobin Type A1c
HBM	Health Believe Model
ICC	Inter-Item Correlation Coefficient
IDF	International Diabetes Federation
LMICs	Low- and Middle-Income Countries
MoH	Ministry of Health
NCD	Non-Communicable Disease
NGO's	Non-Governmental Organizations
PCBS	Palestinian Central Bureau of Statistics
PHC	Primary Health Care
SPSS	Statistical Package for Social Sciences
T2DM	Type 2 Diabetes Mellitus
UNCTAD	United Nations Conference on Trade and Development
UNRWA	United Nations for relief and working Agency for the Palestine Refugees in the Near East
WHO	World Health Organization
CDC	Center for Disease Control and Prevention

Chapter one

Introduction

1.1 Background

Diabetes mellitus (DM) is one of the most non-communicable diseases (NCDs) and a major public health concern which affects nearly 8.5% of population worldwide, and results in severe consequences (World Health Organization, 2016). DM is a metabolic disorder results from lack of insulin secretion and / or resistance to insulin effect (American Diabetes Association -ADA, 2021). It was a fatal disease until discovery of hypoglycemic agents and being treatable at all stages, however, long term complications remain very high. It has been documented that 80% of patients are from less developed countries (International Diabetes Federation-IDF, 2014) and Palestine is among these countries. In the Gaza strip, the prevalence of DM has reached 6.3% and 49% in overall diabetic population above 18 and 60 years, respectively (MoH, 2021).

DM is classified mainly into type 1 and type 2 in which the last one is the most prevalent type (> 87% of cases) and so the case of Palestine is. It has been reported that 50% of patients are undiagnosed (IDF, 2014) and are at risk for serious complications affecting physical (Rohani, 2019), psychological (Karla, Jena and Yeravdekar, 2018) and social aspect of life (Elrayah-Eliadarous et al., 2017). Among these complications, oral diseases are an example and include periodontitis, bone loss, oral candidiasis and not least gingivitis. Evidence have proved DM to cause pathological changes on oral cavity. The list is long, however, it is summarized mainly in fungal infection, xerostomia (dry mouth), dental caries, burning mouth syndrome, tooth and bone loss and periodontal disease (Rohani, 2019). Most of oral changes are not pathognomonic to diabetes (Newman et al., 2014), however, are considered early signs for diabetes. Indeed, dentists have major role to early discover of DM by recognizing these signs since most patients remain undiagnosed with DM.

Periodontal diseases are group of diseases that influence the backup apparatus of the teeth and include the gingiva, periodontal ligaments, cementum and alveolar bone. Indeed, these four components are functioning as one unit to maintain tooth stability. Chronic periodontitis is an irreversible condition that may lead to bone and tooth loss if left untreated. The effect of DM on periodontal tissue has been widely investigated and revealed association between

DM and periodontitis (Botero et al., 2012; Susanto et al., 2011). The bi-directional relationship between DM and periodontitis is well described in study of Chiu et al., (2015).

Dental caries result from the effect of acidic and proteolytic agents which lead to destruction of dental hard tissue. According to Sanz, Nieto and Nieto (2013), dental caries is a common infectious disease affecting humankind. The condition if remain untreated, tooth structure became weak and resulting in cavitation. It is complex in nature and multi-facet disease and is familiar to be linked to behavioral and dietary factors (Sanz, Nieto and Nieto, 2013). In addition to its clear and direct association with DM (Latti et al., 2018).

To the best of the researcher knowledge, there is limited of information about oral health and dental status among patients suffered from T2DM whom received and followed their care in public primary health centers. Information are quite concealed and this study is aiming to disclose it.

1.2 Statement of the problem

According to Palestinian Ministry of Health (MoH) report in 2021, the incidence of DM in the Gaza strip is 149.4/100.000 population (MoH, 2021). DM is a serious disease if left untreated due to its long-term negative consequences especially on oral health. Patients with type 2 DM (T2DM) have shown to have 29% and 22% increased risk for periodontitis and bone loss (Jimenez et al., 2012). In addition, the odds to have periodontal tissue destruction is three times higher among un-control DM (Newman et al., 2014).

In the Gaza strip, Dental care is provided at MoH and The United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) clinics, in addition to private clinics. To the best of researcher knowledge, oral health status was not widely studied among patients with T2DM in Palestine. Two studies were found, extracted from master thesis, addressing periodontal status and DMFT index, however, among T2DM attending UNRWA clinics only. The studies revealed high chronic periodontitis and DMFT index worsen by diabetes. In addition, patients were unaware of oral implications of diabetes (Alqedra and Aljeesh, 2020a; Alqedra and Aljeesh, 2020b). To the best of researcher's knowledge, there is lack of information on oral health status in T2DM patients attending governmental primary health centers (PHCs) and their awareness and perception about implications of DM on oral health. The available information are presented in annual reports in terms of dental care and number of patients served, however, precise and detail information on oral health status in patients with T2DM are not available.

1.3 Justification

The researcher is a dentist who recognized many cases of irreversible oral complications among T2DM patients. Health insurance do not cover costs of most oral diseases and thus this will carry burden over patients' economic situations. Simple oral hygiene practices and preventive measures would eliminate this burden.

This study is the first to be conducted at governmental PHCs among patients with T2DM. The study is expected to estimate prevalence of common oral diseases associated in T2DM and to assess patient’s awareness and perception about DM implication on oral health. Such findings will provide good insight to policy makers about the burden of oral diseases on Palestinian healthcare system. Moreover, to change current policies and interventions at all levels of care; first at PHC level, a focus will be given more on education and prevention. Second, at secondary health care level though introducing of essential services, thus will contribute to prevent occurrence of NCDs. In another hand, patients will be interviewed to explore their needs from information and education and services.

The health belief model will be used to explore patients' perception of benefits from, barriers to oral health practices, susceptibility to and severity of oral diseases. Understanding patients' perception will guide stakeholders at government level to establish health promotion programs toward engaging patients at risk into preventive practices. The study will contribute to determine vulnerable groups for oral diseases resulting from T2DM. Such findings would be helpful to allocate better resources for better outcomes. New areas and gaps for further research will also be discovered and introduced to researchers and stakeholders to fill gaps for further improvement of population oral health.

In the last, this work will complement what had previously done in the UNRWA clinics, by Alqedra and Aljeesh, to include governmental PHCs. By and large, both data could be used as national data for figuring out national prevention program among T2DM patients and improve their quality of life.

1.4 General Objective:

This study is intended to examine oral and dental health status for patients with T2DM attending governmental PHCs and explore challenges and implications on the Palestinian health system.

1.5 Specific Objectives:

The study has the following objectives:

- To measure prevalence of oral diseases, periodontitis and DMFT, among T2DM patients attending governmental PHCs.
- To illustrate variations of DMFT and periodontitis in regard to socio-demographic and clinical characteristics.
- To assess T2DM patients' awareness around diabetes implications on oral health.
- To illustrate T2DM patients' perception toward oral complications and oral hygiene .
- To describe oral hygiene practices of T2DM patients.
- To explore patients' experience and care preferences related to oral health**.**

1.6 Context

1.6.1 Geographical and demographical context

The Gaza Strip (GS) is a piece of land bounded to Egypt in the south and the west by the Mediterranean Sea. It is the highest dense and crowded area, where approximately two million inhabitants live in 365 km^2 (PCBS, 2022). The estimated density is 5,853 individual per square kilometer. It represents 6.1% of the total area of Palestinian national authority land. It is divided into five governorates: North of Gaza, Gaza city, Mid-Zone, Khan-younis and Rafah representing 19.8%, 33.8%, 14.4%, 19.7% and 12.4% of the total Gaza area, respectively (MoH, 2021). Most Gazan population are young in which 40.9% are under 15 years, 30.2% between 15-29 years and 4.5% are above 60 years old (MoH, 2021).

1.6.2 Socio-economic context

Israeli policies against GS had serious negative effect on Gazans economic situation especially after al-Aqsa Intifada in 2000 and became more severe after the Palestinian division in 2007. Most funds from international donors have been frozen, in addition, restrictions have been made to import and export of materials resulting in lack of raw materials.

In the 11-year period from 2007 to 2018, the economy of Gaza grew by just 4.8%. Its share in the Palestinian economy shrank by 13 percentage points, from 31 per cent in 2006 to 18 per cent in 2018. The gross domestic product (GDP) per capita shrank by 27 per cent, and unemployment increased by 49 per cent and poverty increased by 42 per cent. In 2020, the United Nations Conference on Trade and Development stated that the Gaza GDP components remained 5.7 times below their 2006 levels (UNCTAD, 2020). By and large, the deteriorating economy status affected the government revenues from taxes which are an important source of financing for health. Moreover, dependency on internationals donations increased dramatically

1.6.3 Health care system

The Palestinian health care system is described as fragile and complex. Many health care providers are in ground to provide redundant health services. The health care system is divided into three level: Primary health care, secondary and tertiary healthcare. Health care system in Palestine is operated by three main health providers: the Ministry of Health (MoH), the United Nations for relief and working Agency for the Palestine Refugees in the Near East (UNRWA), and Non-Governmental Organizations (NGO's), in addition to private for profit and military services. The MoH is the main player in the Palestinian healthcare system and provides primary, secondary and tertiary care, in addition to its stewardship role. The UNRWA is the second largest provider which delivers its services to formally registered refugees. It provides mainly primary and public health services through 22 primary health centers serving all refugees who represent nearly 82.9% of Gazan population. Benefiters, in the UNRWA clinics, are screened annually for diabetes mellitus status by measuring the glycated hemoglobin Type A1c (HbA1c) twice a year and through regular check using fasting blood glucose. In addition, health education and follow-up schedule are set periodically which include oral health and systematic assessment. While MoH have 52 primary health centers which form 32.7% from primary health centers at Gaza with 86 dentists serve at PHCs for oral and dental treatment with rate 0.5 dentist for every 10.000 patients. (MoH, 2021)

Palestinian healthcare system is overburdened with non-communicable diseases (NCDs) such as DM, hypertension and cancers. With regard to DM, the incidence reached 14.9/1000 population in 2021 with an increase of 39% over the year 2020 (MoH, 2021). While the incidence reached 24.7/1000 population in 2019 compared to 22.4/1000 population in 2018 with 10.2% increase (MoH, 2019). Overall, the prevalence is 6.3%, 17.6% and 49% in

general population, above 18, 40 and 60 years. The Middle area zone is the most prevalent governorate followed by Khanyounes with prevalence 39.4/1000 and 27/1000 population, respectively. Mortality from DM reached 2.3/1000 in which females represented 47% from total mortality.

Dental care services are provided by the ex-mentioned providers. MoH provides this service in some hospitals and through 27 dental clinics at primary health care centers distributed in the five Gaza governorates. In 2021, the total number of patients who received oral and dental health services in PHCs was 20,994 (MoH, 2021), however, dental services are restricted to some dental treatments, while other necessary interventions are not inclusive.

1.7 Operational definition

1.7.1 Controlled Diabetes Mellitus

The American Diabetes Association (ADA) mentioned that glycemic target for non-pregnant adults with diabetes is below 7.0%. Thus, a HbA1c below 7.0% indicates glycemic control and above 7.0% indicates glycemic uncontrolled. a value of HbA1c <7.0% has been shown to decrease macro-vascular and micro-vascular diseases and complication (ADA, 2021).

Diagnosis of DM is made with various approaches. it is mainly based measuring fasting and random blood glucose level. fasting blood glucose id determined by fasting over-night (8-1-hours) and resulted are interpreted as normal (<110mg/dl), prediabetes (110-126 mg/dl) and >126 mg/dl or higher on two separate tests. the test is followed by examining random blood sugar, and no matter when a person ate, a level of 200 mg/dL or higher suggests diabetes (ADA, 2021)

1.7.2 Oral Health Assessment

1.7.2.1 Oral Health:

The mouth which includes the gingiva, the supporting connective tissues, the tongue, the hard and soft palate, the throat, the ligaments, the lips, the salivary glands, the chewing muscles, and the upper and lower jaws and teeth are healthy and free from any disease and pain.

1.7.2.2 Periodontitis:

It is an inflammatory disease that affects the periodontium, the tissue that surrounds and supports the teeth, leading to increase of periodontal pocket, loss of attachment and bone resorption. The WHO community periodontal index and periodontal probe (Figure 1.1) are used to measure the pocket depth and signs for loss of attachment. Signs are considered moderate and severe if the pocket depth is 4-5mm and > 6mm, respectively. According to the WHO periodontal probe, loss of attachment is normal if it is from 0-3mm, and 4-5mm Cemento-enamel junction (CEJ) within black band. It also could be mild given it is 6-8mm CEJ between upper limit of black band and 8.5 mm ring. Loss of attachment is moderate or severe given CEJ is 9-11mm between 8.5 mm and 11.5mm ring, and 12 mm or more CEJ beyond 11.5 mm ring, respectively (Ting,1999). Teeth 16,17,11,26,27,36,37,31,46 and 47 are used to examine presence or absence of loss of attachment (Annex.4).

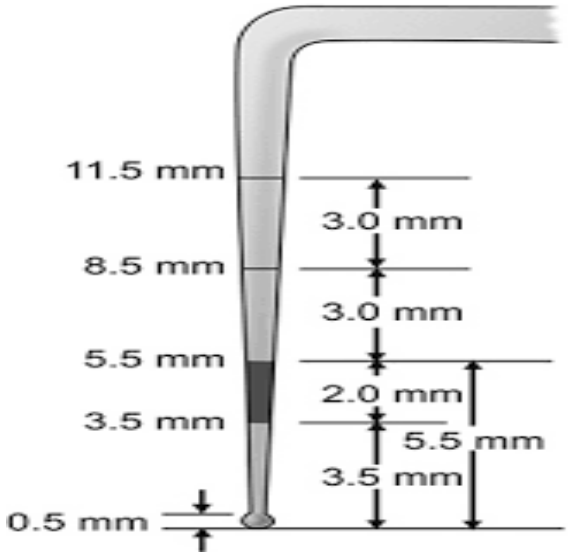

Figure (1.1): WHO community periodontal index probe)

1.7.2.3 Community Periodontal Index (CPI):

CPI is originally developed by the WHO to predict and measure periodontal disease at community level. The score of CPI index ranges from 0 (healthy periodontal condition) to 4 (severe form of periodontal pocket). In details score 1 refers to gingival bleeding, score 2 refers to calculus formation and gingival bleeding, whereas score 3 of CPI index refers to shallow periodontal pockets from 4 to 5mm. For examination, a special dental CPI probe (WHO-probe) is used and type of intervention is based on degree of periodontal severity

(Li et al., 2011). Gomes-Filho et al. (2018) did classify periodontitis into three categories named mild, moderate and severe. Mild periodontitis: ≥ 2 interproximal sites with CAL ≥ 1 mm and ≥ 2 interproximal sites with PPD ≥ 4 mm (not on the same tooth) or ≥ 2 site with PPD ≥ 5 mm with beeding on probing. Moderate periodontitis: ≥ 2 interproximal sites with CAL ≥ 3 mm (not on the same tooth) or ≥ 2 interproximal sites with PPD ≥ 4 mm (not on the same tooth) with beeding on probing. Severe periodontitis: ≥ 2 interproximal sites with CAL ≥ 5mm (not on the same tooth) and ≥ 2 interproximal site with PPD ≥ 5 mm with beeding on probing. No periodontitis: no evidence of mild, moderate, or severe periodontitis

1.7.2.4 DMFT Index:

It is one of the most common used indices in surveys of oral health according to distribution of dental caries (Shulman and Cappelli, 2008). The Decayed, Missing, and Filled Teeth (DMFT) index has been used for almost 90 years and today is established as population-key measure of caries experience in dental epidemiology. It quantifies dental health status based on the number of carious, missing and filled teeth. The index, however, does not provide an accurate description of previous dental care nor does it provide information regarding the severity of the carious attack or the indicated treatment. Coding of the DFMT index sheet used for dental examination is as follow: "D" stands for dental caries and takes code (1). "F" stands for filling teeth and takes code (2,3,6). "M" stands for missing teeth and takes code (4,5) (Fig. 3.1).

DMFT is the sum of the number of Decayed, Missing due to caries, and Filled Teeth in the permanent teeth. The mean number of DMFT is the sum of individual DMFT values divided by the sum of the population (WHO, 2016).

1.7.2.5 Oral health practices:

It describes how often individuals brush and floss their teeth and adhere to behaviors which maintain healthy oral cavity and teeth.

1.7.2.6 Socio-demographic characteristics:

These represent personal characteristics such as age, gender, employment status, education, might have a potential influence on individual health status. Economic aspects; which represent financial status and includes income might play a role in influencing oral health

practice. Also, social factors like number of family members might contribute to severity of and/or deterioration of dental status.

1.7.2.7 Clinical characteristics:

These refer to number of clinical variables attached to each individual and are related to T2DM. These are duration of having T2DM, previous complains of oral diseases, family history of oral complications from T2DM, type of T2DM treatment, and last FBS reading. The ex-mentioned are verified in the literature to trigger severity and occurrence of oral and dental complications for patients with T2DM.

Chapter Two

Conceptual framework and Literature Review

Based on the literature and her intuitions regarding this subject, the researcher created this tentative conceptual framework. The framework made it possible to connect the Health Believe Model, awareness, and oral health practice logically, as well as the ways in which these factors influence clients' viewpoints and their oral health status in relation to their sociodemographic and clinical features.

2.1 Conceptual framework

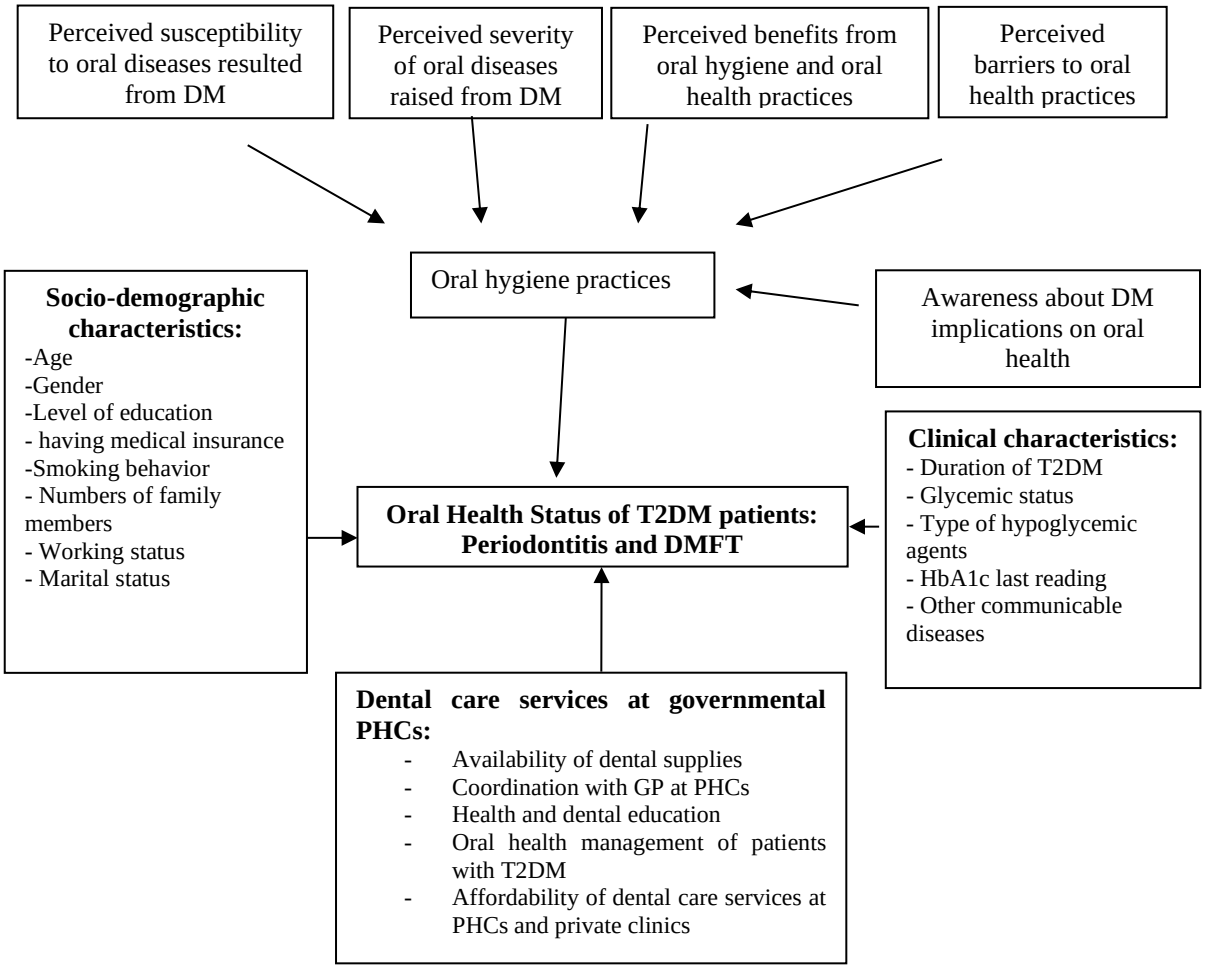

Figure (2.1): Modified conceptual framework

2.1.1 Oral Health Status (periodontitis and DMFT)

These end results complications are mainly associated with or even caused from individual poor oral hygiene practices. According to literature, the more adherence to good oral hygiene practices the less oral complications are, taking into considerations other predisposing and associative factors related to individuals and clinical management of DM (Singh et al., 2019). Periodontitis is an inflammatory disease affects the periodontium, the tissue that surrounds and supports the teeth, leading to increase of periodontal pocket, loss of attachment and bone resorption. The disease is examined by the WHO periodontal probe (Fig. 1.1). The DMFT index is used to determine decayed, missing and filling teeth.

2.1.2 Health Believe construction

The HBM suggests that individual's adoption of healthy behavior is driven by his / her belief on threat of an illness or disease along with his / her a belief in the effectiveness of the endorsed health behavior (Jones et al., 2015). The model has four components: perceived susceptibility, perceived severity, perceived benefits and perceived barriers.

Perceived susceptibility refers to individual's perception of the risk of having an oral diseases, periodontitis and dental caries. Perceived severity refers to individual's feelings on the seriousness and severity of getting an oral diseases, periodontitis and dental caries. Perceived benefits refer to individual's perception of the effectiveness of health behavior, oral hygiene practice, to minimize the threat disease. Perceived barriers refer to individual's feelings on challenges to act and practice oral hygiene. A set of questions will be asked in each construct to measure the perception.

2.1.3 Awareness about implication of DM on oral health

It measures level of knowledge around implications of DM on oral diseases. It is also seen as driver toward compliance and follow of best oral hygiene practices, and finally occurrence of oral diseases. A set of question will be delivered to patients to explore their awareness

2.1.4 Oral Health Practices

These are practices to maintain a healthy mouth and strong teeth. There are a few things you can do, including brushing with fluoride toothpaste twice daily for two minutes each time while using the vertical brushing motion, changing your toothbrush every four months,

flossing daily between your teeth to remove dental plaque, rinsing your mouth with a medicated mouthwash to prevent gum disease, and visiting the dentist at least once a year, if not more frequently. Keeping diabetes under control lowers the risk of developing other dental problems, such as gum disease. Serum glucose level may be reduced by treating gum disease (Center for Disease Control and Prevention - CDC, 2021). A series of questions will be asked to determine how well they follow recommended oral health procedures.

2.1.5 Socio-demographic and clinical characteristics

Numerous socio-demographic variables are seen to be linked with occurrence of and affecting oral diseases among T2DM patients. The independent variables includes gender, age, level of education, having medical insurance or not, smoking behavior, numbers of family members, working status, and marital status. Moreover, clinical characteristics of participants will also be studied and examined their association with occurrence of oral diseases. They include duration of T2DM, glycemic status, type of hypoglycemic agents, HbA1c last reading, other communicable diseases.

2.2 Literature Review

2.2.1 Concept and Definition of oral health status

Oral health is frequently recognized as a crucial sign of general health, and quality of life. It includes a variety of illnesses and ailments, such as tooth loss, periodontal disease, and dental caries. According to the Global Burden of Disease Study (2019), about 3.5 billion people worldwide are predicted to be affected by oral disorders. The majority of oral illnesses and disorders have modifiable risk factors in common with the most common noncommunicable illnesses, like diabetes. These risk factors, which are all on the rise globally, include using tobacco products, drinking alcohol, and eating unhealthily with a lot of free sugars. There is evidence linking dental health to overall health. For instance, it has been suggested that diabetes plays a role in the onset and progression of periodontitis. Additionally, there is a connection between high sugar intake and DM, obesity and dental caries (WHO, 2021).

2.2.2 Importance of oral health in diabetes patients

A healthy oral cavity is vital for everybody, however increase serum blood sugar level can interfere human body and make it tougher to preserve the mouth healthy. Appropriate oral health practices can help prevent pain and infections from tooth and gum disease. Therefore, it is essential to keep and maintain general health and well-being including oral health. Diabetes Mellitus and oral complications are interrelated. Patients with T2DM are shown to suffer from many oral complications especially xerostomia, tooth decay, loss and periodontitis. In addition to serious fungal and bacterial infections (Simpson et al., 2015). Many studies approved association between low quality of life and poor oral health status (Nikbin et al., 2014; Irani, Wassal & Preshaw, 2015). They have been shown that poor oral health status is reflecting in physical disability, physical pain, psychological discomfort, and psychological disability. Moreover, Awkwardness experienced by patients with T2DM who suffer from oral complications may depress them to perform oral hygiene resulting from pain or irritation in the oral cavity. Various health risks are reported from poor oral hygiene and conclusive evidence revealed bad general health and well-being are resulted from poor oral hygiene. Some of these diseases are endocarditis, cardiovascular diseases, dementia, and not finally osteoporosis (Ahmad, & Haque, 2021).

2.2.3 Patients' perception about oral complications from T2DM

2.2.3.1 Perceived susceptibility to oral health complications

Globally, patients with major systemic conditions, including T2DM, have poor knowledge (< 50%) of the oral health associations to their condition (Akl, 2021). Additionally, 46,3% of Turkish people are knowledgeable about health impact of DM (Cankaya et al., 2018).

In Ethiopia, 18.8% of participants agreed that a person with diabetes is at higher risk of getting periodontal disease, and 25.5% perceived that periodontal disease can result in heart disease (Sahile et al., 2020). In china, 72% of participants were perceived susceptible to diabetes complications, including oral manifestations, and its risk factors **(**Tan, 2004). In another study from Turkey, patients were mostly aware of their susceptibility to complications rise from DM and include mouth dryness (46.7%), tooth decay (25%), malodor (23.3%) and bleeding gums during tooth brushing (22.9%). However, patients perceived less susceptibility to other complications like mouth ulcers and taste impairment (11.7%) and fungal infection (4.6%) (Çankaya, et al.,2018).

2.2.3.2 Perceived severity of oral health complications.

Patients in the study of Abdullah and his colleagues (2017) have considered T2DM more serious than periodontitis, despite the severity of periodontitis itself. In Ethiopia, 64% perceived severity of oral health complications resulted from DM (Sahile et al., 2020). Slam et al. (2021) revealed 40% of his patients perceived positive toward severity of complications of DM on the oral cavity including tooth mobility and bleeding gum.

2.2.3.3 Perceived benefits from oral health practices.

Sahile et al. (2020) found 53% of participants perceived benefits from oral health practices in prevention of periodontitis**.** Another study conducted on large sample of DM patients, patients perceived benefits from oral hygiene and resulted in substantial reduction in gingival bleeding and oral inflammation (Holmer et al., 2018). Lee et al. (2009) revealed that patients' perceived good benefits from intensive oral hygiene care which will help in slow periodontal deterioration and improve oral inflammation status.

2.2.3.4 Perceived barriers to oral health practice.

Many barriers have been reported in literature. Poudel et al. (2021) found that dental costs were the most contributing factor to avoid or delay dental visit. Moreover, lack of insurance coverage and access to dental care were also highlighted as verified by 71% and 70% of participants, respectively (Shimpi et al., 2019). Similarly, from Saudi Arabia, Fadel et al. (2021) reported variations between frequency of oral health practices and dental visits, in which long waiting time and high treatment costs were the main drawbacks. Indeed, self-efficacy and awareness about oral health implications of T2DM were strong predictors for dental and oral health behaviors (Malekmahmoodi et al., 2019). Furthermore, fear and anxiety were also highlighted (Gordon, Dionne & Snyder, 1998), and inadequate training and follow up by dentists (Younel et al., 2020).

One study conducted in Turkey by Cankaya et al. (2018) found low guidance from healthcare professionals regarding oral health care. Moreover, clinicians failed to provide information about importance of oral examination and oral care, tooth brushing, maintenance of optimal oral health and interdental cleaning.

Almost all DM patients informed their dentists about their diabetes. Most of the patients stated that their dentist should inform them about importance of good oral health care on the management of DM.

An example of poor oral health-related-behavior as documented by the literature is that individuals with diabetes were less likely to have visited a dentist in the past 12 months compared with individuals without diabetes (Chaudhari et al., 2012).

2.2.4 Awareness of diabetic patients about the effect of diabetes mellitus on oral health.

Diabetic patients are unaware of the association between DM and oral health, and only a small portion of them visit dentists for routine dental check-ups. A study conducted by Allen et al. (2008) examined the knowledge of 101 diabetic patients about their susceptibility and risk for oral diseases especially periodontal disease and their attitude toward oral health. Only one third were aware of their increased risk for periodontal disease. Moreover, Eldarrat (2011) study revealed low awareness of diabetic patients of their increased risk for oral complications compared to awareness regarding systemic diseases. Similar findings were obtained twenty years ago by Moore et al. (2000), who found patients were unaware of oral health complications and the necessity for preventive care. A recent study conducted by University College Hospital, Ibadan revealed large proportion of interviewees were unaware about oral manifestation of DM. Indeed, few named at least one oral manifestation associated with DM. High awareness was correlated with good glycemic control (Adeyemi, Abimbola & Kolude, 2019). Similarly, Parakh and his colleagues reported a very low awareness score among T2DM patients (Parakh et al., 2020).

A very recent study used the HBM, by Malekmahmoodi and her colleagues (2020), investigated patients' perception of susceptibility, severity to oral diseases in addition to benefits from and barriers to implementation of oral health practices. The study was conducted among 120 T2DM patients and findings showed that score of knowledge, perception of susceptibility and severity, benefits and barriers was average.

Lack of oral health knowledge, poor attitudes were also reported in literature (El-Ashkar et al., 2019; Poudel et al., 2021). In Saudi Arabia, 63.4% of participants were aware of the effect of DM on oral health, 82.7% were aware about the need of diabetic patients for

specialized healthcare (Mian et al., 2020). In Saudi Arabia, diabetic patients are aware about importance of controlling their diabetes in order to minimize oral health complication, but only very few of them visits the dentist regularly. Additionally, awareness of T2DM patients around oral diseases and complications is low compared to their knowledge of systematic diseases (Eldarrat, 2011).

In return, Ismail and Ali (2013) found low level of awareness among Saudis. Variation within the same country could be attributed to limited educational campaigns and weakness of their primary health facilities, especially in remote areas. Paurobally et al. (2020) found DM patients are aware of the association between DM and common systematic diseases, however, knowledge about oral complications of diabetes was limited (caries [29%], periodontal disease [37%], and xerostomia [52%]). Predictors for awareness of complications are education level and years since diagnosis of DM.

Overall, patients with diabetes exhibit poor oral health behaviors and little awareness about oral health. It is crucial to inform patients of their elevated risk for oral health issues, encourage them to adopt healthy oral hygiene habits, and make it easier for them to receive dental care (Poudel, 2018).

2.2.5 Oral health practices

In China, 22% only did brush the teeth twice daily (Aggarwal & Panat, 2012). Similarly, Kamath et al. (2015) had end with same findings. In England, most respondents (79.8%) had visited s dentist once or twice a year and 67% did brush their teeth at least twice, whereas, 15% did floss their teeth (Bowyer et al., 2011).

In the Arabic setting of Saudi Arabia, Al Amassi et al. (2017) found 45.6% of respondents brush their teeth once daily, 10.4% floss once daily, and only 11.5% use mouthwash regularly. Paurobally et al. (2022) reported that Mauritians are more than twice as likely to visit their dental care provider at least once annually. A study conducted by Slam and her colleagues (2021) found half of diabetic patients follow tooth brushing twice a day, and most patients either visit when necessary or never visited the dentist. A call for interprofessional education and interprofessional collaborative care was raised by Siddiqi et al. (2020) after finding 61% of participants reported brushing their teeth twice a day.

Kanjirath and her colleagues (2011) surveyed 448 Americans about importance of oral health related behaviors and found patients with diabetes brushed and flossed less frequently. Patients with diabetes who did not brush regularly had poorer periodontal health.

Kanjirath, et al. (2011) found that individuals with diabetes were less likely to brush and floss compared with individuals without diabetes, suggesting poor oral health-related behavior.

It is necessary to recognize the significant effect of lifestyle modifications and behavior changes on reduce burden and complications of DM on oral health status. lack of knowledge about association between DM and oral complications reduces the compliance to oral hygiene practice (Masood Mirza et al., 2007). In the Arabic setting, a study from Tunisia revealed 44% of diabetic patients brushed their teeth at least twice a day, 25% brushed once a day, and 21% did not used to brush their teeth (Imen Sebai, 2019). Good oral self-care is associated with good glycemic control (Taylor & Bognakke, 2008) and good oral health status (Kanjirath et al., 2011).

Today, people are becoming more knowledgeable of and conscious of proper dental hygiene habits. For a variety of reasons, including to feel fresh, to prevent bad breath, or even to maintain a clean oral cavity, people may brush their teeth. In Western culture and society, brushing teeth twice a day with fluoride toothpaste has become standard practice (Van Der Weijden & Slot, 2011).

Patients with diabetes, compared to non-diabetes, had more mobile teeth (14% vs. 8%, $p=0.023$), gingival recession (16% vs. 12%, $p=0.035$), and more teeth with recession in the esthetic zone (1.17 vs. 0.88, $p=0.046$). Additionally, they had more teeth caries (11 vs. 7, $p<0.001$) and more surfaces that were missing, decaying, and filled (101 vs. 82, $p<0.001$). Patients with diabetes who brushed and flossed less frequently had worse periodontal health (the percentage of teeth with probing depths of 4 mm was 82% vs. 60%, $p=0.039$; the percentage of teeth with probing depths of 4 to 6 mm was 34% vs. 17%, $p=0.059$) and more caries (32% vs. 15%, $p=0.033$) than those who regularly brushed their teeth (Kanjirath et al., 2011).

2.2.6 Oral complications and manifestation of diabetes mellitus

Various oral diseases and soft tissue defects have been documented to be associated with T2DM. These are periodontal diseases (periodontitis and gingivitis), salivary dysfunction

and taste dysfunction. Oral candidiasis and bacterial infections have also been noticed (Chomkhakhai et al., 2009). In addition, dental carries, tooth loss and delayed mucosal wound healing have been reported in patients with T2DM (Lamster et al., 2008). The prevalence and the chance of developing oral mucosal lesions were found to be higher in patients with diabetes compared to healthy controls (Saini et al., 2010).

2.2.6.1 Periodontitis

Association between T2DM and periodontal disease is not well acknowledged yet. According to Rajhans et al. (2011), prevalence and severity of periodontal disease increased among patients with T1DM and T2DM. It is not yet known how hyperglycemia influences occurrence of periodontal destruction. Many theories exist behind of which factors such as advanced glycation end products (AGE) and changes in collagen statue led to impaired polymorphonuclear leukocyte function. This mechanism enhances bacterial persistence in the tissue and increased secretion of pro-inflammatory cytokines such as tumor necrosis factor-α and prostaglandin E-2 (Cekici et al., 2014) . A study conducted by Preshaw and his colleagues (2012) revealed that periodontitis has a bidirectional effect on glycemic status in patients with T2DM. The risk of periodontitis increases with diabetic patients who have uncontrol glycemic status (Preshaw et al., 2012).

Other contributing factors have also been reported that make T2DM patients more susceptible to periodontitis such as smoking, poor oral hygiene and long duration of DM (Irwin et al., 2007). In return, smoking was found to be a major preventable risk factor for periodontitis and tooth loss in diabetic patients and in the general population as well (Chaffee, Couch & Ryder., 2016).

Rajhanset et al. (2011) and Barrientos et al. (2019) showed that periodontitis is highly prevalent among diabetic patients. Moreover, it is more severe than non-diabetics (Khader et al., 2006; Radebe, 2009). An old study conducted by Bacic and his colleagues (1998) revealed that missing teeth are high among diabetic patients and pathological pockets (≥ 6 mm) was significantly higher in diabetic than non-diabetic patients. Moderate periodontitis, measured by The Picture of Periodontal status (PSR) index ≥4, was noticed in 68% of diabetic patients (Simon et al., 2020). Individuals with diabetes are three time risky for periodontitis than those without diabetes, however, the risk is much lower among patients live with controlled T2DM (Alpert., 2017).

The relationship between diabetes and periodontitis is truly bidirectional, as it is well proven that hyperglycemia negatively impacts oral health through overproduction of the advanced glycation end product (AGE) (Kuo et al., 2008), and severe periodontitis can negatively impact glycemic control (Garton et al., 2012). Advanced glycation end products have a systemic impact that results in over excretion of cytokines leading to local oral inflammation and a loss of dental connective tissue (Amar & Hans., 2003). Gingival pockets that are deeper than 4 mm are more common in diabetics than nondiabetics, and patients with pockets greater than 2 mm deep are at an increased risk of diabetes compared to patients with pockets less than 1.3 mm deep (Scannapieco., 2005)

In 2012, Morita and her colleagues discovered a direct correlation between the onset of periodontal illnesses and pockets larger than 4 mm and higher levels of hemoglobin A1c. (Morita et al., 2012). Since the 1940s, researchers have been looking at the connection between diabetes and periodontitis. However, there are conflicting findings on the connection between the two chronic diseases in the published studies. The Study of Health in Pomeria (SHIP) trend from 2015 revealed no correlation between well-controlled diabetes, prediabetes, and periodontitis (Kowall et al., 2015). However, Nascimento et al. (2018) found in their meta-analysis of prospective cohort studies that patients with diabetes had an 86% higher risk of periodontitis advancement (RR = 1.86; 95% CI = 1.3-2.8) than non-diabetic participants. There were 5.8% of people who had diabetes. In a sample of 1911 people in Norway, Holde et al (2017) found that 3.8% of individuals with periodontitis also had diabetes.

In a study involving 736 participants in Italy, Aimetti and her colleagues (2015) found that diabetes prevalence was 5.3% among those with moderate-to-severe periodontitis. In this study, the findings of logistic regression analysis revealed no correlation between diabetes and periodontitis (OR: 2, 95% CI= 0.64-6.24). According to a recent Norwegian study (2020), of the non-diabetic group, 38.2% had mild periodontitis and about 11% had severe periodontitis. A healthy oral status was seen in 27.2% of non-diabetic participants. Approximately 59% of people with diabetes had moderate to severe periodontitis. It was discovered that there were equivalent numbers of diabetes participants in the healthy and mild periodontitis groups (Alex, 2020).

It is well understood that chronic periodontitis affects the entire body in addition to the periodontal tissues. Numerous investigations have revealed a link between systemic diseases like diabetes, rheumatoid arthritis, low birth weight babies, and cardiovascular and respiratory illnesses and periodontal disease (Hajishengallis, 2015). Additionally, those with severe periodontitis had a 3.5 times increased chance of acquiring diabetes (Morita et al., 2012). A five-year follow-up research found a link between periodontal disease and declining glycaemic control (Demmer,et al., 2010). However, a seven-year follow-up Japanese investigation found no connection between periodontitis and the prevalence of diabetes (Ide et al., 2011).

As chronic periodontitis progresses, oral bacteria, bacterial products, and inflammatory mediators may pass through ulcerated periodontal tissues and into the systemic circulation, resulting in a chronic low-grade systemic inflammatory state (D'Aiuto et al., 2010). According to Almaghlouth et al. (2014), people with periodontitis had higher levels of systemic inflammatory chemicals. It's interesting to note that changing the composition of the gut microbiota is one of the postulated pathways for the systemic effects of periodontitis on diabetes. After oral delivery of P.gingivalis to mice, systemic inflammatory alterations were seen, indicating that oral bacteria can upset the healthy microbial ecosystem of the gut and cause systemic inflammation (Arimatsu et al., 2014). Periodontitis is thought to be a predictor of non-oral problems in diabetic patients (Borgnakke et al., 2013). In contrast to caries risk, Kogawa and his colleagues discovered that T2DM patients were more susceptible to periodontal tissue injury. Additionally, they offered some evidence that T2DM (CAL 7 mm) patients with poor glycemic control experience a considerable decline in the degree of attachment loss (Kogawa, 2016).

2.2.6.2 Dental caries and tooth loss

Bacterial colonization on tooth surfaces is what leads to dental caries. It happens when dietary carbohydrates (such as sweets, breads, and starches) break down and release acids that demineralize teeth (Benjakul & Churnarrom, 2011). T2DM patients are more prone to oral infections resulting in tooth decay and loss. Bissong and his colleagues (2015) reported higher prevalence of dental carries in patients with T2DM compared to their counter-part non-diabetic patients. The relationship between diabetes and development of dental caries is still unclear. However, it is hypnotized that the leaked glucose into the oral cavity facilitates

the growth of aciduric and acidogenic bacteria and thus dental caries developed (Latti et al., 2018). In addition, Latti and his colleagues (2018) reported increased incidence of dental caries among T2DM patients suffered from xerostomia (dry mouth). It has been hypothized that dental carries occur with patients who have uncontrolled glycemic status. the DMFT index was found to be significantly high among diabetes patients (Jawed et al., 2011). However, one study revealed that the presence of tooth decay was not correlated with HbA1c (Imen Sebai et al., 2019).

In opposition to dental caries, a sufficient salivary flow rate promotes a protective oral environment. Fluoride, calcium, and phosphate levels in saliva that are satisfactory would significantly lower the likelihood of dental caries developing (Jawed et al., 2011). Using the DMF-S, Ribeiro et al (2022) study discovered that patients with T2DM had significantly higher rates of dental caries (RR = 1.37; 95% CI = 1.09-1.71). The average number of missing teeth in the US was 10.1 + 7.2. (Simon et a., 2020). According to Hintao et al. (2007), patients with T2DM and non-diabetic individuals had different rates of periodontitis, decayed/filled root surfaces, and root surface caries. T2DM had a significantly greater prevalence (40.0% vs 18.5%, 1.2 vs 0.5, and 98.1% vs 87.4%, respectively).

Additionally, dental caries was shown to be more prevalent (32% vs. 15%, respectively) in T2DM individuals who brushed their teeth erratically as opposed to frequently (Kanjirath et al., 2011). A study by Kateeb et al. (2015) among 370 diabetes patients from Palestine found that the mean DMFT was 9±0.5.

The African study involved 356 people with diabetes and was carried out in the west of the continent. Uncontrolled diabetes led to an increase in periodontal illnesses as determined by the CPITN and the DMF index. On the other hand, DMFT index and duration of DM are linked to poor periodontal health. Coelho et al. (2020) were unable to distinguish between groups with relation to dental caries despite higher levels of HbA1c. The substantial correlation between T2DM and tooth loss was found by Ahmadinia et al. (2022) in a very recent systematic and meta-analysis study. Data on the link between dental caries and diabetes from epidemiological research are contradictory. Some studies have found that diabetic patients experience more caries (Arheiam et al, 2014; Jawed et al, 2011). On the other side, there is more evidence that indicates that persons with diabetes have a higher prevalence of root caries (Lalla et al, 2012).

2.2.6.3 Bacterial Infections

Similar to its systematic effect, DM has an impact on development of oral bacterial infection resulted from complex and multifaceted factors such as impaired immune system. Periodontal abscess, as a clinical characteristic, is important for diagnosis of DM (Alagl, 2017). Farcas-Berechet and his colleagues (2019) revealed radiological changes of the apical periodontium among T2DM patients, either lower and / or upper jaw, which is a significant indicator for bacterial infection. *Streptococcus* species are the commonest isolated bacteria which it is responsible for dental caries at oral cavity (Rao et al., 2010).

2.2.6.4 Fungal Infections

andida albicans infection of the mouth, particularly pseudomembranous candidiasis, is predisposed by diabetes mellitus. Additionally, non-albicans species (Pichia, Trichosporon, and Geotichum) have been found in the oral cavity of diabetic patients who have poor blood sugar management and are more prone to severe fungal infections. A high concentration of glucose in the blood and saliva, which fungi can use as food, is linked to poor glycemic control. This may cause the periodontal microbiota to experience an excessive inflammatory response. Additionally, there is a link between having removable prosthesis or smoking cigarettes and a higher incidence of fungus infections in diabetics (Poradzka et al. 2013).
According to a study conducted in Nepal, people with diabetes had a greater prevalence of fungal infection (34.0%) than people without diabetes (4.7%). Oral wash was found to have a greater level of fungal growth. Aspergillus species (28.4%), Candida species (57.5%), and Trichophyton species (10.7%) made up the majority of the fungus. People with diabetes are more prone to developing a fungus than participants without diabetes. Overall, the two most common fungus are Aspergillus and Candida species (Saud and others, 2020)

2.2.7 Prevalence of oral diseases in diabetes mellitus

As previously mentioned, DM is associated with increased frequency of oral diseases. A systematic review conducted by González-Serrano et al. (2016) estimated prevalence of oral mucosal disorders as high among T2DM and T1DM compared to their counterpart's non-diabetic patients. The prevalence was between 45–88% in T2DM patients to 38.3–45% in non-DM groups and from 44.7% in T1DM patients to 25% in non-DM population. In a cross-sectional study performed in China, chronic periodontitis was reported in 47% (453/962) of studied participants with T2DM. periodontitis was more prevalent among diabetic patients

compared to health group (Awuti et al., 2020). Similarly, from Korea, Hong and his colleagues (2016) reported 46.7% of diabetes patients having periodontitis compared to control groups with normal fasting glucose level. The more severe and high prevalence is reported from India, in which 95.1% of diabetes patients had some form of periodontitis. However, severity of diseases was associated with pattern of oral hygiene practices; the poor hygiene practices the more the diseases is severe (Singh et al., 2019).

Dental caries and its burden on the diabetic population are of noteworthy public health concern. Various studies have reported prevalence for dental caries. A cross-sectional study conducted by Malvania et al., (2016) in India found prevalence of dental caries more in diabetes patients compared to non-diabetes group. The prevalence was 73.3% and 33.3%, respectively. Among 175 Mexicans with T1DM and T2DM, dental caries and tooth loss were noticed in 50% of them (Patiño Marin et al., 2008). In the Arab world, a very recent study from the United Arab Emirates found significant proportion of patients with T2DM (23%) had a clinical attachment loss ≥ 3 mm compared to non-diabetic patients (Khalifa et al., 2020).

Overall, 43.8% of people have poor oral health. Poor oral health status was found to be substantially correlated with age, smoking, alcohol use, diabetes, education, income, depression, marital status, and amount of sleep, according to a univariate study. after taking into account covariates (age, sex, diabetes mellitus, hypertension, obesity, smoking, income, education, marital status) (Han et al., 2021).

2.2.8 Socio-demographic and clinical characteristics association with oral health complications.

2.2.8.1 Smoking Effect on oral health among diabetics.

Smoking is a harmful and unhealthy behavior which has been proved to influence many pathological conditions (Heydarpour et al., 2018; Parker et al., 2014). Obradovic and his colleagues (2012) found smoking had negative influence on periodontal status among patients with T2DM and T1DM. Similarly, periodontal disease was significantly worsened among group of patients with T2DM compared to healthy group (Gupta et al., 2016; Obrak et al., 2002). These findings were supported by a study of Jawad and his co-workers which showed that DM and smoking are determinants for worsening periodontal status among diabetic patients (Javad et al., 2015). These results revealed that DM damage the periodontal

tissue and smoking trigger this effect. A very recent case control study in smoking and non-smoking groups with and without DM, showed effect of smoking on periodontal tissue even in healthy ones. However, the effect is multiplied in diabetes group (Battancs et al., 2020). Smoking significantly increases the risk of gingival hemorrhage and loss of attachment (Nwhator et al., 2005; Seitz et al., 2019). The impact of smoking on bleeding on probing (BOP) for plaque sites in gingival marginal areas was investigated in a study by Holde et al. (2017). According to the study's findings, current smokers had lower overall odds of developing BOP than non-smokers (OR in current smokers= 1.45; OR in non-smokers= 2.2). Furthermore, smokers are five times more likely than non-smokers to experience severe periodontitis, according to Paul, Soni, Vaid, Basavaraj, and Khuller (2014). Additionally, smokers frequently have more deep periodontal pockets and deeper averages for periodontal probing. This indicates that more areas of periodontitis are present, and the pockets that develop between the gums and teeth are deeper.

Additionally, it has been shown that patients with periodontal inflammatory disorders are more prone to smoke and use tobacco than people who do not. (Javed F, et al, 2014). Not only smoking causes periodontal disease, but also negative smoking are also associated with periodontal disease (Javed et al., 2014). The third most common preventable cause of mortality in the US is negative smoking, also known as environmental or passive smoking. Smoking has also been demonstrated to increase the risk of tooth loss and implant failure. Oral cancer is linked to smoking and accounts for 2.5% of all types of cancer in the United States (Viswanathet al, 2013).

The literature unequivocally demonstrates the harmful consequences of excessive sugar consumption and cigarette smoke on oral and general physical health. In order to maintain healthy teeth, it is crucial for people to avoid bad habits like smoking and to keep an eye on their daily sugar intake. The results of quitting smoking's impact on dental health are given special consideration. We draw the conclusion that there is strong epidemiologic evidence for the detrimental effects of tobacco smoking and other tobacco use on oral health. Additionally, there is strong evidence to back the positive effects of quitting smoking on a variety of oral health outcomes. Abstinence and successful smoking cessation can have a significant positive impact on oral health in a range of demographics and people of all ages (Warnakulasuriya et al., 2010).

2.2.8.2 Age and gender effect on diabetic oral health status.

Age of diabetic patients is seemed to influence the oral health status, however, the relationship remains unclear. Lacerda and his colleagues (2011) found high prevalence of periodontitis among younger when compared to non-diabetic healthy participants. In return, oral mucosal lesions developed more on patients above 5th decade of life (Adeyem, Abimbo & Kolude, 2019). Age was a significant factor in many studies (Yi-hong cheng et al., 2019; Bernabé, Sheiham & Age, 2014). In addition, females were more prone to decay, missing and filled teeth than their counterpart males (Benev, 2015; Shaffer et al., 2015). Additionally, elders above 60 years are also prone to periodontal diseases (gingival bleeding, loss of attachment) if they are diabetic (Ilea, 2019; Ueno, 201; Seitz et al., 2019). Moreover, males had worse periodontal status compared to their counterparts' females (Schulze et al., 2016). Kassebaum et al. (2014) evaluated 72 research from 37 different countries between 1990 and 2010 and found that the prevalence of severe periodontitis remained stable as people aged, with an age-standardized incidence of 701 instances per 100,000 person-years. Additionally, it was observed that participants aged 45 to 68 had lower risks of developing BOP than those in the 20 to 34-year age group (Holde et al., 2017).

2.2.8.3 Effect of education level on diabetic oral health status.

Patients with higher levels of education (graduate and postgraduate) showed significant better brushing habits and more awareness regarding oral health problems from diabetes in comparison with those with low levels of education (Al Amassi et al., 2017).

High level of education is associated with better knowledge toward oral health practices, Bayraktar et al. (2009) had reached similar results among Turkish diabetes patient.

It was discovered that among new and referred patients arriving to the University of North Carolina Graduate Periodontology Clinics, less oral health literacy was linked to more severe periodontal disease (Wehmeyer et al, 2014). Therefore, it is crucial that the oral health professionals who care for patients with diabetes prioritize teaching them the value of proper dental self-care.

2.2.8.4 Effect of duration of DM on oral health status.

Duration of DM could have a significant contribution when oral health and DM are examined together. Indeed, results about effect of duration of DM on oral health is contradicting. Ribeiro and his colleagues (2011) proved the link of DM duration with

development of oral symptoms. Coronal caries was higher in the long compared to short duration of DM (Singh et al., 2019). A study conducted by Adeyemi, Abimbo and Kolude (2019) mentioned that oral manifestations increased with development of time and duration of DM. In return, Ribeiro et al. (2011) reported no association between duration of DM and periodontitis when age was controlled.

2.2.8.5 Effect of glycemic control of DM on oral health status.

Ravindran and his colleagues (2015) revealed that both managed and uncontrolled diabetes require rigorous preventative monitoring and early treatment since oral symptoms in uncontrolled diabetes are more severe. Moreover, xerostomia, clinical attachment loss, the number of missing teeth, and plaque index were all associated with diabetes control level (HbA1c) and type of anti-diabetic medication (Nikbin et al., 2014) .

The duration of diabetes, FBG, and compliance with self-management of diabetes were all substantially correlated with periodontal parameters, such as the number of lost teeth and papillary bleeding index. Diabetes duration, FBG, and HbA1C all had a substantial impact on CPI. Diabetes duration, FBG, HbA1C, and compliance with self-care of diabetes all had a substantial impact on Russell's periodontal index. Multiple linear regression analysis revealed a substantial positive link between the duration of diabetes and periodontal health parameters, with the exception of tooth loss. Russell's periodontal and papillary bleeding indices were linked with HbA1c. Missing teeth and the papillary bleeding index were respectively linked with FBG and compliance to self-management of diabetes. (2013) (Kim et al., 2013).

According to a study conducted in Serbia, patients with poorly controlled diabetes had significantly more tooth decay than those with better control (6.5±4.3 vs. 4.3±2.9; p0.05). Only PPD (5.7±0.9 vs. 5.2±0.8; p0.05) among periodontal markers was significantly greater in patients with poorly controlled diabetes than in those with better management. Only the age of the patient showed a positive link for the DMFT score, PI, PPD, and CAL. By and large, periodontal disease and insufficient control of diabetes and caries are related (Stojanovi et al., 2010).

2.2.8.6 Effect of other chronic disease with diabetes on dental status

The mean of DMFT is higher among patients who reported having chronic conditions compared to those who did not, according to a retrospective study by Kim et al. (2021), but the difference is not statistically significant. Patients with histories of both hypertension and asthma have higher means, followed by those with histories of both hypertension and cancer and kidney illness. Researchers are interested in studying the relationship between non-communicable diseases and oral health because both conditions are complex and are marked by chronic inflammatory responses (Dorfer et al., 2017; Kedar et al., 2018). One explanation for this connection is because long-term use of drugs for chronic illnesses can cause dry mouth and decreased saliva flow, which can lead to an oral bacteria overgrowth. Dental caries and periodontitis are both caused by oral microbes, which are detrimental to oral health (Rosier, Marsh, Mira, 2018).

Chapter Three

Methodology

3.1 Introduction

Research methods include study design, study populations, study setting, study period, eligibility criteria, sample size and process, study instruments, data collection and analysis of quantitative and qualitative data, in addition to scientific rigor, limitation of the study, ethical consideration and pilot study.

3.2 Study design

To achieve the goal and objectives of the study, the researcher employed a convergent mixed method design. Quantitative and qualitative approach were used simultaneously at same time to collect data on oral health status for patients with T2DM. Mixed methods research is becoming common track within health care research as it allows for greater integration of data and information within a complex healthcare setting. This approach provides better understanding of the research problems. According to Tashakkori and Teddlie (1998), mixed method design is conducting for the following purposes: triangulation of findings, examination of overlapping or different facets of a phenomenon, initiation or discovering of contradictions, and/or perspectives, and expansion to add to the breadth or scope of the project. In the quantitative approach, cross sectional analytic design was applied, while interview based study was followed for the qualitative study.

3.3 Study populations

The study population includes patients with T2DM who visited governmental PHC clinics. According to MoH (2021), the total number of patients with DM has reached 66,209 at MoH and UNRWA. The prevalence is 6.3%, 17.6% and 49% among patients above 18, 40 and 60 years old, respectively (MoH, 2021). The overall registered number of T2DM patients is 11088 patients in governmental PHCs distributed in the five governorates: 1389, 5949, 918, 2173 and 689 in the north, Gaza, middle area, Khanyounes and Rafah governorate, respectively. In addition, the percentage of distribution is 12.5%, 53.5%, 8.25%, 19.5% and 6.2%, respectively.

3.4 Eligibility criteria

3.4.1 Inclusion criteria

- Patients should be diagnosed with T2DM not less than 5 years.
- Participant should be cooperative
- Participant should be above 40 years old
- Participant should have at least 20 teeth in their oral cavity.

3.4.2 Exclusion criteria

- Diabetic patients who visit other facilities and are not willing to participate
- Individuals who haven't any teeth in their mouth
- Older individual who can't talk or have Alzheimer disease

3.5 Study period

The researcher started working on the thesis in January, 2021 after obtaining approval from the School of Public Health – Al Quds university and the ethical permission from the Palestinian Health Research council. Data collection phase begun in May, 2021 and lasted for six months given that interruption occurred as a result of Israeli escalation during this period. Attached is table of activities to be implemented and expected to fulfill (Annex 1).

3.6 Study setting

The MoH in Gaza operates and runs 52 PHCs distributing in five governorates. Five PHCs, which have dental services, were randomly selected in which one PHC represents a governorate. These PHCs are Beit Lahia Martyrs, Al-Remal Martyrs health center, Der-Albalh Martyrs clinic, Khanyounes Martyrs clinic and Rafah Martyrs clinic .

3.7 Sample size and sampling process

3.7.1 Quantitative data

For the quantitative part, the sample size was calculated using the online SurveyMonkey website, available at https://www.surveymonkey.com/mp/sample-size-calculator/. The sample was calculated according to the last report of MoH (2021) which showed that the prevalence of T2DM is 17.6% giving approximately a total of 11088 individuals above 40

years. Sample calculation was done at 5% error and 95% confidence interval and revealed 372 patients should be included (Annex.2).

Two stages sampling approach were followed. The first stage is by random selection of one PHC from each governorate. Second stage is random selection of participants, following proportionate stratified systematic sampling. The sample size was proportionally distributed in the five governorates: 48 from the north, 199 from Gaza, 31 from the middle zone, 73 and 25 from Khanyounes and Rafah, respectively. Then, a list of females and males patients was prepared from each health center included in the study. The K^{th} interval equals 30.

3.7.2 Qualitative data

Evidence about least number of participants for interview-based studies is inconsistent, however, suggestions of 5 to 25 participants of a homogenous group should be included until saturation of information is reached (Vasileiou et al., 2018). The researcher started with 10 patients and continued to meet patients until no new knowledge is added. Thirteen patients, who were part of quantitative study, were purposefully recruited for the qualitative study.

3.8 Study instrument

3.8.1 Quantitative study

A self-developed questionnaire was used to collect necessary data. The PubMed, Google scholar and the Directory of Open Access Journals database were used to search for relevant literature. The questionnaire comprised four parts:

Part I includes information about socio-demographic (age, gender, marital status, education level, income, working status) and clinical characteristics (type of treatment, duration of T2DM, presence of complications, last HbA1c reading, other chronic diseases).

Part II assesses patients' perceptions using the four constructs of HBM; perceived susceptibility to oral complications (5 questions), perceived severity of oral complications (7 questions), perceived benefits from oral hygiene (4 questions) and perceived barriers to oral hygiene (4 questions).

Part III measures patients' awareness about implication of T2DM on oral health and comprises (8 questions).

Part IV measures patients' behaviors to oral hygiene practices (10 questions). Questions of knowledge were measured on three points Likert scale (yes, no, don't know), and questions of the HBM were measured on five points Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree). Moreover, similar Likert scale was used for questions of oral hygiene practices (1=never, 2=rare, 3=sometimes, 4=often and 5=always) (Annex 2).

The researcher received approval from the involved PHCs administration to use dental chairs and examine patients upon, however, instruments are owned to the researcher. Examinations included DMFT, bleeding gum, periodontal pocket and loss of attachment. Infection prevention and control standards were taking into considerations when dealing with patients and between patients. Later, patients were taken to NCDs nursing room to continue data collection and fill out the questionnaire.

Patients were asked about their last HbA1c reading and in case they didn't recognize, his / her medical file was reviewed accordingly.

Examination of DMFT

Patients were asked to sit on dental chair for dental examinations in which mirrors and probes were used accordingly. The DMFT index was used to discover decayed, missing and filling teeth by a mirror and a probe (Annex 4). Coding of the DFMT index sheet used for dental examination is as follow: "D" stands for dental caries and takes code (1). "F" stands for filling teeth and takes code (2,3,6). "M" stands for missing teeth and takes code (4,5) (Fig. 3.1).

Code			Condition/status
Primary teeth	Permanent teeth		
Crown	Crown	Root	
A	0	0	Sound
B	1	1	Caries
C	2	2	Filled, with caries
D	3	3	Filled, no caries
E	4	–	Missing due to caries
–	5	–	Missing for any other reason
F	6	–	Fissure sealant
G	7	7	Fixed dental prosthesis abutment, special crown or veneer/implant
–	8	8	Unerupted tooth (crown)/unexposed root
–	9	9	Not recorded

Figure (3.1): Coding the dentition status – primary and permanent teeth

Examination of gingival bleeding and periodontal pockets

In return and for periodontitis, loss of attachment was explored using the community periodontal index and measurement of probing pocket depth (PPD) and bleeding on probing (BOP). PPD is measured on a 6-point scale per tooth, and BOP is counted over 30 sec following BOP.

Gingivae of all teeth present in the mouth was examined by carefully inserting the tip of the WHO CPI probe between the gingiva and the tooth to assess absence or presence of bleeding response. The sensing force was used not more than 20 g. When the probe was inserted, the ball tip followed the anatomical configuration of the surface of the tooth root. The probe tip was inserted gently into the gingival sulcus / pocket and the full extent of the sulcus / pocket was explored.

The probe was moved gently, with short upward and downward movements, along the buccal sulcus / pocket, to the mesial surface of the second molar. A similar procedure was carried out for lingual surfaces, starting on the distolingual aspect of the second molar. All

teeth were probed and scored in the corresponding box. The codes for scoring bleeding , pocketing and loss of attachment are given at clinical examination sheet (Annex.4).

3.8.2 Qualitative study

In-depth interview guiding questions (Annex.5). A semi-structured interview guide was developed by the researcher to answer questions raised previously. Interview guide answered questions about patient's awareness of T2DM implications on oral health and effectiveness of oral health practices. Moreover, to capture patients' care preferences regarding information and education and dental services.

3.9 Ethical consideration

Ethical approval was obtained from the School of Public Health, at Al-Quds University and the Helsinki Committee of the Palestinian Health Research Council (PHRC/HC/858/21). Moreover, permission was obtained from the general directorate of human resources at ministry of health to conduct the study in its PHCs (No: 686506) (Annex 8 and 9).

Patients were delivered with information regarding study' objectives. Anonymity and confidentiality were ensured and voluntary participation as well. Patients were asked to sign an attached consent prior filling the questionnaire. Similar steps were applied to qualitative study. The researcher sought permission from key informants to record interviews.

3.10 Pilot study

Prior data collection, a piloted study was conducted on at least 20 patients to examine appropriateness of study instrument and clearance of items. Moreover, interview guide was tested on two patients to check language structure and understanding of questions. A pilot test of the interview guide was conducted from three health experts. The pilot test was necessary to ensure that questions were applicable to all patients within the diverse group of individuals that were sampled. Accordingly, some sentences were edited or rephrased.

3.11 Data collection

3.11.1 Quantitative data

Data collection took place in the preselected PHCs during the day shift by the researcher herself. Participated patients were driven to dental room for clinical checkup of oral health status. After that, they have been asked to fill the questionnaire.

The twenty patients who participated in pilot study was excluded from the main study sample. Specialist of periodontics “Dr. Nael Al-Masri” was consulted for appropriate way of dental examination using the CPI probe .

3.11.2 Qualitative data

Thirteen patients who participated in the quantitative study were purposefully selected for interviews. The researcher conducted interviews in separate room within the PHCs. Information about study objectives was provided to participants and patients were asked to sign a consent before the researcher begin after interview. Mobile was used to record interviews.

The interview aims to discover the participant’s experience of a particular situation. It further allows the researcher an opportunity to pursue the topics of interest in depth, to probe further topics which may arise during interviews, and to clarify misinterpretations which may occur. The qualitative part was done by the researcher himself. Interviewees were part of the quantitative study. Before I begin the interview:

- I let the participants review the written information about the study.
- I asked if there are any questions about the study (stressed that interview is voluntary).
- Participants signed the informed consent.
- I described the background to the study and why it is important.
- I described the aim of the study.
- I explained why interviews were chosen.
- I emphasized the confidential nature of the discussions “everything that is being said by individuals during the interview stay between these four walls” .
- I explained that the interview will be taped and transcribed to text.

3.12 Scientific rigor

3.12.1 Quantitative approach (questionnaire)

3.12.1.1 Reliability

Instruments was piloted and tested for internal consistency (alpha cronbach) and test re-test reliability using inter-item correlation coefficient (ICC) among 20 patients suffered from T2DM. two weeks later, the same questionnaire was distributed to same 20 patients and test re-test reliability was calculated accordingly. Reliability of the HBM, awareness on oral manifestations of T2DM and oral hygiene practices were measured using internal consistency and test re-test reliability. The alpha cronbach (α) was 0.64, 0.62 and 0.61, respectively. This means that the questionnaires applied in the study is reliable.

Cronbach Alpha is a subject of controversies due to its excessive use. Many researchers highlighted the question of its estimator's power and looked for alternative methods for testing a scale reliability (Bernardi, 1994; Christmann and Van Aelst, 2006). By and large, alpha cronbach of between 0.6 and 0.7 indicates an acceptable level of reliability, and 0.8 or greater is a good level. However, reliability coefficient more than 0.95 is not necessarily good, because it might be an indication of redundance (Hulin, Netemeyer, and Cudeck, 2001).

Moreover, test re-test reliability, measured by ICC and Pearson correlation, ranged between 0.90 to 0.99 and 0.94 to 0.99, respectively. Test re-test reliability, employing Pearson and intra-class correlation, shows significant correlation ($P < 0.0001$) between repeated domains after two weeks period (Annex 7).

3.12.1.2 Validity

The questionnaire was sent to twelve experts to evaluate items relevancy to their domains. Nine experts responded and their comments were taken into consideration. In addition, content validity index, items (I-CVI) and scales content validity index (S-CVI), was examined accordingly. Moreover, the questionnaire was distributed to tweenty patients before commencing the study to ensure readability and understandability of questionnaire's items, and accordingly patients' comments were carefully considered.

Nine referees provided their comments and rated validity of the questionnaire' items in accordance with their domains. The I-CVI and S-CVI ranged between 0.78 to 1 and 0.89 to 1, respectively . This means that the questionnaire items are content valid and agreement between raters / referees is not coincident as interpreted by $k > 0.79$ (Annex 8).

3.12.2 Qualitative approach (in-depth interview)

Interview guide was presented to three health experts and dentists who have public health experience to ensure trustworthiness of questions, and to answer research questions. Moreover, interview guide was tested on two patients to make sure that questions are easy to be posed and understand by patients (Annex 5). Audio records were transcript into papers.

3.13 Data analysis

3.13.1 Quantitative data analysis

The Statistical Package for Social Sciences (SPSS) version 22 was used in data analysis. Prior analysis, data were checked for missing and extreme values and if a questionnaire has missing values of 5% or more, the questionnaire was discarded and not used for analysis. Descriptive and inferential statistics were approached. Continuous variables (age, duration of DM, ..) were presented inform of mean and standard deviation, whereas, categorical variables (gender, level of education, …) were presented inform of frequency and percentage. T-test and one-way ANOVA were used to compare independent variables with presence of periodontitis or not. Multivariate logistic regression was approached to determine independent variables associated with periodontitis. P-value < 0.05 was considered statistically significant.

3.13.2 Qualitative data analysis

The researcher approached thematic analysis method. The researcher read interviews twice to obtain general consensus and understand patients' feedbacks. No matter how the number was, codes were determined through reading line by line. Codes reflect ideas and then codes which share similar ideas or could be pooled under one domain were presented under subthemes. Finally, main themes were named and presented accordingly.

3.14 limitations of the study

- The study enclosed a sample from MOH clinics and there are other PHC clinics from UNRWA and NGOs did not take part in the study.
- The nature of cross-sectional design which limits causal relationship.

Chapter Four

Results and Discussion

4.1 Introduction

This chapter presents results of statistical analysis, through descriptive and inferential analysis, of the data and interpretation of giving findings .

4.2 Descriptive Statistics

4.2.1 Socio-demographic characteristics of participants

Table (4.1): Distribution of participants according to their socio-demographic information (n = 376)

	Frequency	Percent	M±SD
Age group			57.86±8.76
50 or less	84	22.3	
51-55	69	18.4	
56-60	75	19.9	
61-65	70	18.6	
More than 65	78	20.7	
Residency			
North Gaza	48	12.8	
Gaza city	199	52.9	
Middle zone	31	8.2	
Khan Younis	73	19.4	
Rafah	25	6.6	
Are you smoker (number cigarette/days)			11.45±8.28
Yes	45	12.0	
No	292	77.7	
Ex-smoker	39	10.4	
How many shisha	38	10.1	7.24±3.26
Level of education			
Illiterate	24	6.4	
Up to elementary school	65	17.3	
Up to preparatory school	104	27.7	
Up to secondary school	113	30.1	
University and above	70	18.6	
Marital status			
Unmarried	62	16.5	
Married	314	83.5	
Income			
Under poverty line (< 1974 NIS)	314	83.5	
Above poverty line (≥1974 NIS)	62	16.5	
Number of family member			1.71±0.76
5 or less	102	27.1	
6-10	219	58.2	
More than 10	55	14.6	
Working status			
Working	102	27.1	
Not working	274	72.9	

M: mean, SD: standard deviation

Table (4.1) represents the baseline characteristics of participated patients. The mean age for participants is 57.8±8.76 years. Males and females represent 44.9% and 55.1% of the sample, respectively (Fig. 4.1). Age is divided into five categories and patients below 55 and above 65 years constitute, in each, at least one fifth of the sample size. This distribution is fairly consistent with reports of the Ministry of Health (MoH) which showed that 49% of patients are above 60 years and 44% are from 40 to 59 years (MoH, 2021). Half of participated patients are from Gaza city (52.9%) followed by khan Younis (19.4%) and the least percentage is from Rafah (6.6%).

Majority of participants had formal school education (93.6%), in which 17.3% and 27.7% attended elementary and preparatory schools, respectively. Moreover, 18.6% did at least finish college or university. In addition, almost three quarter have at least 6 children, and are not smokers. In return, the mean number of cigarette smoking is 11.45±8.28 cigarette, and 10.4% are ex-smokers. Most participants are not working at the time of data collection (72.9%), and live under deep poverty line (83.5%). In reference to the PCBS (2017), 53% of population live under poverty line, and 33% live under deep poverty line (≥1974 NIS) at the Gaza Strip.

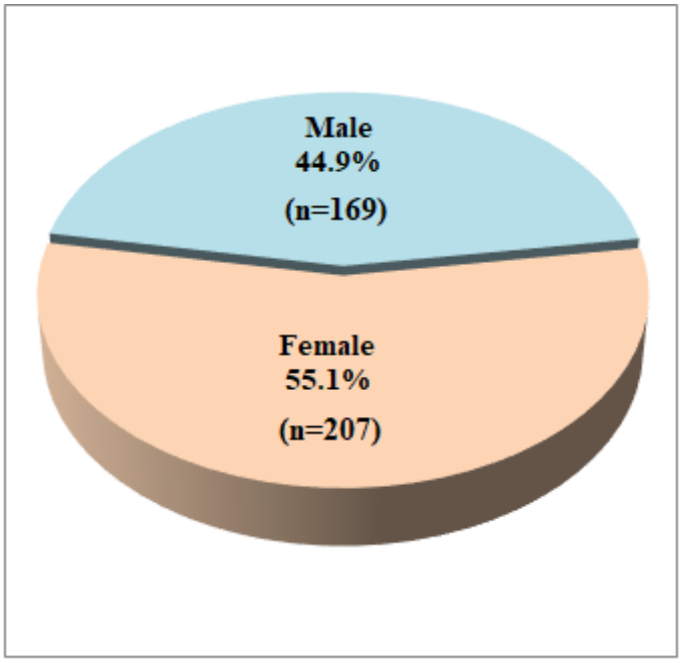

Figure (4.1): Distribution of participants according to gender status.

4.2.2 Clinical Characteristics of participants

Table (4.2): Distribution of participants according to their clinical information (n = 376)

	Frequency	Percent	M±SD
Having medical insurance			
Yes	367	97.6	
No	9	2.4	
Duration DM			10.99±6.61
10 or less	241	64.1	
More than 10	135	35.9	
Family history of oral complications from T2DM			
Yes	186	49.5	
No	190	50.5	
Type of treatment			
Diet restriction and physical activity	18	4.8	
insulin injection	48	12.8	
Oral hypoglycemic agents	246	65.4	
Oral hypoglycemic agents and insulin injection	64	17.0	
Receiving education about oral care			
Yes	78	20.7	
No	298	79.3	
Last reading of FBS			185.9±61.33
≥ 140 mg/dl	113	30.1	
> 140 mg/dl	263	69.9	
Presence other chronic diseases			
Yes	236	62.8	
No	140	37.2	
If yes, specify			
Hypertension	165	43.9	
Hypertension, Heart disease	41	10.9	
Heart disease	16	4.3	
Arthritis	4	1.1	
Asthma	4	1.1	
Hypertension, Asthma	2	0.5	
Arthritis, Hypertension	1	0.3	
Hypertension, cancer	1	0.3	
Hypertension, Kidney disease	1	0.3	
Osteoporosis	1	0.3	
Suffering from oral diseases in the last year			
Yes	300	79.8	
No	76	20.2	
Among yes reporting to have oral diseases in the last year			
Tooth mobility			
Yes	86	22.9	
No	290	77.1	
Tooth loss			
Yes	200	53.2	
No	176	46.8	
Tooth decay			
Yes	219	58.2	
No	157	41.8	
Tooth sensitivity			
Yes	24	6.4	
No	352	93.6	

Table (4.2): Continued

Gum bleeding			
Yes	112	29.8	
No	264	70.2	
Bad Oder			
Yes	68	18.1	
No	308	81.9	
Bacterial infection			
Yes	56	14.9	
No	320	85.1	
Fungal infection			
Yes	39	10.4	
No	337	89.6	
Mouth ulcers			
Yes	56	14.9	
No	320	85.1	
Visiting dental clinic last year			
Yes	213	56.6	
No	163	43.4	
If yes, why			
Consultation/advise	11	2.9	
Pain or trouble with teeth, gums or mouth	215	57.2	
Treatment/ follow-up treatment	105	27.9	
Routine check-up/treatment	12	3.2	
Don't know/don't remember	33	8.8	
Total	**376**	**100.0**	

M: mean, SD: standard deviation

The mean duration of T2DM is 10.99±6.61 years. Almost two third (64.2%) have T2DM less than 10 years. Moreover, two thirds (65.4%) are under treatment with oral hypoglycemic agents (OHA), 12.8% use insulin and 17% on combination between OHA and insulin injection. The remained 4.8% are managed by lifestyle modifications, diet restriction and physical activities. The mean HbA1c value is 8.11%±1.84, and 62% and 38% have uncontrolled and controlled T2DM, respectively (Fig. 4.2).

According to the annual report of UNRWA health department number of patients with non-communicable diseases (NCDs) is increasing consistently by approximately 5% per year (UNRWA, 2017).This is quite obvious when researcher note that the number of DM patients is almost double compared to last 10 years. The report verified that T2DM patients with duration less than 5 years and 5-9 constitute 33% and 26.8%, respectively. Whereas, 22.2% and 18% have DM 10-14 and above 15 years, respectively.

The HbA1c test is an important blood test that gives good indication of how well diabetes status is being controlled. Based on UNRWA categorization of participants according to their HbA1c, participants were divided into two major groups; controlled DM with HbA1c equals or less than 7% and uncontrolled more than 7%. The results show that 21.4% of participants have controlled DM, while 78.6% have uncontrolled T2DM. This result is almost similar with UNRWA reports where the percentage of controlled DM participants was 30 % in 2016, 27% in 2017 and was targeted 30 % in 2018 (Saleh, 2018b). The difference between our finding and UNRWA reports could be attributed to limited age group of the study.

On the other hand, two thirds of participants have other chronic diseases in addition to T2DM, mostly hypertension (43.9%) and hypertension with heart disease (10.9%). Half (49.5%) have family history of oral complications resulted from T2DM. Majority of participants (79.8%) report oral manifestations in the last 12 months, and 56.6% had visited dental clinics accordingly. Common oral manifestations reported by participants are tooth decay (58.2%) and tooth loss (53.2%). Almost 30% and 18.4% suffer from gingival bleeding and bad odor, respectively. Reasons for visiting dental clinics are due to problems with teeth, gum or mouth (57.2%) (Table 4.2).

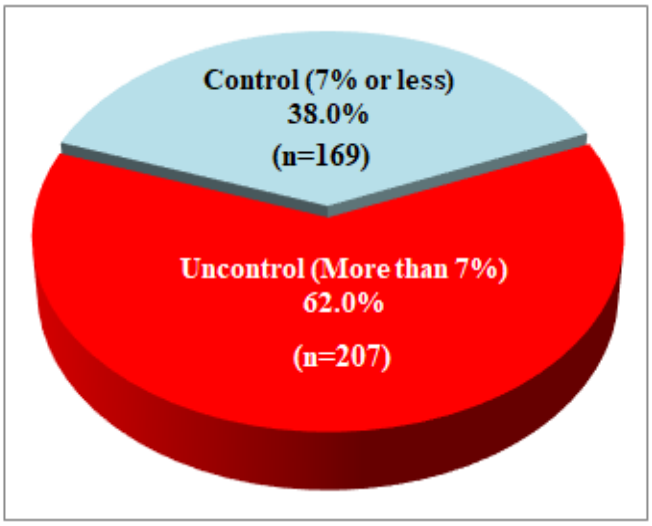

Figure (4.2): Distribution of participants according to control status

Table (4.3): Themes of the qualitative study

Themes	Codes
Quality of dental care services	Accessibility
	Affordability to cost
	Availability of essential dental services
	Lack of dental Lack of medical supplies
	Appointment at PHC Follow up of dental status
Patient dentist relationship	communication
	health education and information
Self-oral care and hygiene	Awareness
	Oral health practices
	Attitudes
Patient's oral health experiences	Dental problems
	Nutrition problems

With regard to qualitative study, the researcher interviewed 13 patients from two main PHCs in Gaza Strip (Al-Remal Martyrs health center and Khanyounis Martyrs clinic) to explore patients' experience and care preferences related to oral health. They were 7 females and 6 males and their age range from 47 to 72 years old (Annex 10). Fourteen codes were extracted and four themes were formulated accordingly; Quality of dental care services, Patient dentist relationship, Self-oral care and hygiene and Patient's oral health experiences (Table 4.3).

4.2.3 Patients' perception about oral complications from T2DM

4.2.3.1 Perceived susceptibility to oral health complications

Table (4.4). Participants' responses regarding susceptibility to oral complications (n = 376)

Perceived susceptibility to oral complications items	Strongly Disagree n(%)	Disagree n(%)	Neutral n(%)	Agree n(%)	Strongly Agree n(%)	M	SD	% mean
I am not at risk for developing dental caries.*	21 (5.6)	209 (55.6)	49 (13)	84 (22.3)	13 (3.5)	2.63*	1.00	67.40*
Because I am diabetic patient, I am riskier to develop oral diseases than others.	1 (0.3)	70 (18.6)	51 (13.6)	225 (59.8)	29 (7.7)	3.56	0.89	71.20
My teeth are healthy because i don't suffer from dental pain	7 (1.9)	99 (26.3)	58 (15.4)	194 (51.6)	18 (4.8)	3.31	0.98	66.20
Although I have DM, my good health status protects me from getting oral complications.	6 (1.6)	76 (20.2)	50 (13.3)	220 (58.5)	24 (6.4)	3.48	0.94	69.60
I am at higher risk of getting oral complications because of family history of oral complications resulted from DM.	8 (2.1)	155 (41.2)	66 (17.6)	138 (36.7)	9 (2.4)	2.96	0.98	59.20
Total						**3.22**	**0.32**	**64.40**

M: mean, SD: standard deviation

The mean score of perceived susceptibility to oral complication is 3.22 (0.32) on five point Likert scale, which means that 64% of patients see themselves susceptible to oral complications. In detail, quite three quarter see themselves at risk for developing complications than others because of T2DM, and so if there is family history of oral complications (59%). Moreover, quite two thirds disagree with the statement "I am not at risk for developing dental caries" (61.25%) (Table 4.4).

From the qualitative study, few (2/13) have dis-admired relationship between T2DM and oral complication, and so DM has no effect on the teeth.

"Diabetic does not affect teeth ,there is no relation between them"(Male,Khanunis,64 years)

In return, majority did agree about oral problems raised from DM and it is effect not only on teeth and oral cavity, but also on body system

"Sure, diabetic disease affect my teeth and nerves and everything at my body…"(Male,Khanunis,57 years)

"There is direct relationship between diabetic disease and teeth problem, diabetic make bad odor for mouth"(Male,Khanunis,63 years)

"high glucose affects my eyes, teeth and even my effort, it affect everything …"(Female,Gaza,51 years)

Globally, patients with major systemic conditions, including T2DM, have poor knowledge (< 50%) of the oral health associations to their condition (Akl, 2021). Additionally, 46,3% of Turkish people are knowledgeable about health impact of DM (Cankaya et al., 2018).

In Ethiopia, 18.8% of participants agreed that a person with diabetes is at higher risk of getting periodontal disease, and 25.5% perceived that periodontal disease can result in heart disease (Sahile et al., 2020). In China, 72% of participants were perceived susceptible to diabetes complications, including oral manifestations, and its risk factors **(**Tan, 2004). In another study from Turkey, patients were mostly aware of their susceptibility to complications rise from DM and include mouth dryness (46.7%), tooth decay (25%), malodor (23.3%) and bleeding gums during tooth brushing (22.9%). However, patients

perceived less susceptibility to other complications like mouth ulcers and taste impairment (11.7%) and fungal infection (4.6%) (Çankaya, et al.,2018).

4.2.3.2 Perceived severity of oral health complications.

Table (4.5). Participants' responses regarding severity of oral complications (n = 376)

perceived severity of oral complications items	Strongly Disagree n(%)	Disagree n(%)	Neutral n(%)	Agree n(%)	Strongly Agree n(%)	M	SD	% mean
Oral diseases are not easy to manage*	14 (3.7)	168 (44.7)	29 (7.7)	159 (42.3)	6 (1.6)	2.93*	1.04	58.60*
the thought of getting oral complications scares me	21 (5.6)	97 (25.8)	65 (17.3)	146 (38.8)	47 (12.5)	3.27	1.14	65.40
If I got oral complications, my physical status would badly change	6 (1.6)	59 (15.7)	18 (4.8)	246 (65.4)	47 (12.5)	3.72	0.93	74.40
Getting oral complications will affect my social relationship (cannot laugh, interact and speak with others,..)	17 (4.5)	89 (23.7)	27 (7.2)	199 (52.9)	44 (11.7)	3.44	1.11	68.80
Getting oral complications will bring heavy economic burden to me and my family	1 (0.3)	36 (9.6)	7 (1.9)	260 (69.1)	72 (19.1)	3.97	0.79	79.40
Developing oral complications would be more serious than other diseases	20 (5.3)	82 (21.8)	58 (15.4)	180 (47.9)	36 (9.6)	3.35	1.08	67.00
Total	3.39		0.45			67.80		

M: mean, SD: standard deviation

Most patients perceive severity of oral complications as high (67.8%). The mean score is 3.39(0.45) on five point Likert scale. Majority (79.4%) believe that oral complications have significant economic burden which affect both patient and the family. Sixty seven percent believe that oral complications are more serious than other diseases because they badly affect patients' physical status (74.4%). In return, oral complications are easy to manage as stated by 58.6% of participants (Table 4.5)

Our findings are comparable with similar studies in developing countries (Moore et al., 2000). Similarly, patients in the study of Abdullah and his colleagues (2017) have considered T2DM more serious than periodontitis, despite the severity of periodontitis itself. In Ethiopia, 64% perceived severity of oral health complications resulted from DM (Sahile et al., 2020). Slam et al. (2021) revealed 40% of his patients perceived positive toward severity of complications of DM on the oral cavity including tooth mobility and bleeding gum.

4.2.3.3 Perceived benefits from oral health practices.

Table (4.6). distribution of participants responses to benefits of oral health practices (n = 376)

Perceived benefits from oral health practices items	Strongly Disagree n(%)	Disagree n(%)	Neutral n(%)	Agree n(%)	Strongly Agree n(%)	M	SD	% mean
Oral hygiene is necessary even if I have no oral symptoms.	3 (0.8)	8 (2.1)	266 (70.7)	99 (26.3)	376 (100)	4.23	0.52	84.60
Oral hygiene practices do not help in prevention of oral complications.*	41 (10.9)	271 (72.1)	32 (8.5)	28 (7.4)	4 (1.1)	2.16*	0.75	43.20*
Early detection of oral complications provides good chance for therapy.	0 (0.0)	7 (1.9)	32 (8.5)	279 (74.2)	58 (15.4)	4.03	0.56	80.60
Routine dental checkup decreases opportunities of oral complications occurrence.	0 (0.0)	5 (1.4)	37 (9.8)	273 (72.6)	61 (16.2)	4.04	0.56	80.80
Total	3.66			0.28		73.20		

M: mean, SD: standard deviation

The mean score of perceived benefits from oral health practice is 3.66 (0.36) on five point Likert scale, which means that 73.2% believe that there are benefits from oral health practices. In detail, 84.6% see that oral hygiene is necessary even if there are no oral symptoms. Moreover, 80.6% see that early detection of oral manifestations provides good

chance for therapy. However, only 56% agree that oral hygiene has no effect on preventing occurrence of oral complications (Table 4.6).

From the qualitative study, Most interviewed patients do consider dental cleanness as an essential component for maintaining the mouth, teeth and oral cavity healthy. Majority of patients show positive attitudes toward importance of follow up in dental clinics.

"…commitment with cleaning tooth has a good effect on health …" (Male,Khanunis,58 years)

"…last 4 months I have a bad breath, I came to treat it and the dentist prescribed me good mouth wash ,then I felt good…" (Male,Khanunis,63 years)

"…I went to check my teeth because I know the effect of diabetic disease on my oral health…" (Female,Gza,63 years)

"…brushing tooth daily with good nutrition is very important…" (Female,Gaza,60 years)

"…we should brush our teeth to prevent gum inflammation …" (Female,Gaza,51 years)

These finding are consistent with results of Sahile et al. (2020) who found 53% of participants perceived benefits from oral health practices in prevention of periodontitis**.** Another study conducted on large sample of DM patients, patients perceived benefits from oral hygiene and resulted in substantial reduction in gingival bleeding and oral inflammation (Holmer et al., 2018). Lee et al. (2009) revealed that patients' perceived good benefits from intensive oral hygiene care which will help in slow periodontal deterioration and improve oral inflammation status.

4.2.3.4 Perceived barriers to oral health practice.

Table (4.7). distribution of participants responses regarding barriers to oral health practices (n = 376)

Perceived barriers to oral health practices items	Strongly Disagree n(%)	Disagree n(%)	Neutral n(%)	Agree n(%)	Strongly Agree n(%)	M	SD	% mean
I fear sitting on dental chair	42 (11.2)	181 (48.1)	42 (11.2)	71 (18.9)	40 (10.6)	2.70	1.21	54.00
Dental brush bleeds my gum	17 (4.5)	171 (45.5)	42 (11.2)	131 (34.8)	15 (4)	2.88	1.06	57.60
I have no adequate information about oral hygiene practices*	17 (4.5)	180 (47.9)	53 (14.1)	123 (32.7)	3 (0.8)	2.77	0.98	55.40
I cannot afford the cost of dental checkup*	7 (1.9)	71 (18.9)	35 (9.3)	237 (63)	26 (6.9)	3.54	0.94	70.80
Total						2.81	0.36	56.20

M: mean, SD: standard deviation

The mean score is 2.81(0.28) on five point Likert scale. More than half (56.2%) of participants perceived many barriers to oral health practices. It is clear that the most important factor to prevent patients from getting their oral health care is inability to afford costs of dental checkup (70.8%). Whereas, half of the participants stated that they fear sitting on dental chair (57.6%), and feel that when they brush their teeth their gum is bleeding (54%). Additionally, 55.40% stated that they have no adequate information about oral hygiene practices. These factors contribute to low practices (Table 4.7).

From the qualitative study, many barriers were reported by interviewed patients and are classified into facility, physician and patient related factors. Regarding facility related factors, interviewees complained of insufficiency of dental services at governmental PHCs and when they came to dental clinic for dental treatment or follow up they didn't find the services due to lack of dental and sometimes medical supplies. Dental services are just limited to tooth extraction. There is no root canal treatment or even tooth restoration or scaling which are an essential dental treatment for diabetic patients to keep healthy gums and teeth. One participant clearly stated that the quality of care is bad because of unavailability of dental supplies and services. Additionally, basic supplies that are used for

general practices and for dental care like gloves, sutures are not available and sometimes dentists request us to purchase them from private pharmacists.

"…When you want to do restoration ,they said it is finished and when you want to do root canal treatment, also they said is not existed, they just do tooth extraction …"(Male,Gaza,47 years)
"…They haven't anything to offer ,bad dental care…"(Female,Khanunis,72 years)
"… I'm taking two taxis to tell me it's finished, go back …"(Male,Khanunis,58 years)
"… I don't come here too much for treatment because they have nothing to offer..."(Female,Khanunis,72 years)
"…They said to there isn't gloves to treat me…" (Male,Khanunis,58 years)

Patients' follow up is important to diabetic patients. Indeed, majority of patients declared that dental clinics at PHCs have no appointment system and patients are not satisfied with follow up system provided by dentists. Moreover, dentists are not found in their workplace and if they exist they do not give appointment for follow up.

"…There is no follow up but only extraction (tooth), and if you need management they say (dentists) do it outside…" (Male,Khanunis,58 years)

"…I rarely follow at PHCs, I follow mainly in private clinics…" (Female,Khanunis,54 years)

"…no one (doctors at PHCs) have asked me about my teeth or referred me to dentist for checkup…" (Female,Gaza,50 years)

Many patients complained of bad time management between cases and they are obligated to wait longer time and at the end, dentists do not treat patients, but they check the teeth for moment and direct patients to continue dental care at private clinic.

"…I don't like to take turn (in governmental dental clinic), I came just when I am so tired from dental pain…" (Female,Gaza,63 years)
"…you should go so early to get number for your turn …."(Male,Gaza,47 years)
"…Dentist doesn't want to work or even treat us…."(Female,Gaza,50 years)

Interviewees claimed dissatisfaction with dentists' behaviors. They complained that dentist do not give enough information to properly care for oral complications. Furthermore, dentists do not ask about medical status and glycemic level. They even do not discuss

effectiveness of diabetes management on oral health. Two participants only are satisfied about communications with dentists

"…they advise me how to brush and rinse my mouth and before they work they ask me and care about me …" (Female,Gaza,63 years)

"…they (dentists) didn't give me any information…" (Male,Khanunis,64;Female,Khanunis,72 years;Female,Gaza,51years;Male,Gaza,47 years)

"…they (dentists) didn't tell us how should we care…" (Male,Khanunis,58 years; Male,Khanunis,72 years; Male,Khanunis,64 years)

"…the care of dentist didn't change when he know that I am diabetic, just he answer me when I asked…" (Male,Khanunis,63 years)

Patients criticized PHCs as they have no formal health education programs for this occasion and information about effect of DM on oral health is mainly based from external sources such as internet websites, friends or TV because dentists do not at all or provide inadequate information

"…I get my information about diabetic disease and its effect from T.V ,internet and my neighbors…" (Female,Khanunis,54 years;Female,Gaza,60 years)

"…they didn't give us health promotion program or any information related to our status…" (Male,Khanunis,58 years)

"…I always read about my disease from internet… " (Female,Gaza,63 years)

"…we go and they didn't even talk to us ,they just examine us and then say goodbye…" (Female,Gaza,50 years)

With regard to patient related factors, Majority of interviewed patients have difficult economic status and they expressed disappointment to dental care services in the governmental PHCs. They state they are unable to afford costs of dental services at private clinics because they are not available in the PHCS. Most of them are in need to replace their extracted teeth with a prosthetic one. They also mentioned that even simple dental treatments

like mouth wash is not available in the PHCs and it costs us a lot because we need it for long time.

"....Expensive (treatments) when you want to rinse your mouth for 16 shekels every time and use an expensive antibiotic...."(Female,Gaza,63 years)
".... I can't pay for dental treatment at private clinics ...."(Male,Khanunis,58 years;Male,Khanunis,63 years;Female,Khanunis,72 years;Male,Khanunis,57 years)
"...Root canal treatment at private sector is expensive I can't pay for it, hope it found at governmental health care ...."(Female,Gaza,51 years;Female,Gaza,60 years)

Many barriers have been reported in the literature. Poudel et al. (2021) found that dental costs were the most contributing factor to avoid or delay dental visit. Moreover, lack of insurance coverage and access to dental care were also highlighted as verified by 71% and 70% of participants, respectively (Shimpi et al., 2019). Similarly, from Saudi Arabia, Fadel et al. (2021) reported variations between frequency of oral health practices and dental visits, in which long waiting time and high treatment costs were the main drawbacks. Indeed, self-efficacy and awareness about oral health implications of T2DM were strong predictors for dental and oral health behaviors (Malekmahmoodi et al., 2019). Furthermore, fear and anxiety were also highlighted (Gordon, Dionne & Snyder, 1998), and inadequate training and follow up by dentists (Younel et al., 2020).

One study conducted in Turkey by Cankaya et al. (2018) found low guidance from healthcare professionals regarding oral health care. Moreover, clinicians failed to provide information about importance of oral examination and oral care, tooth brushing, maintenance of optimal oral health and interdental cleaning.

Almost all DM patients informed their dentists about their diabetes. Most of the patients stated that their dentist should inform them about importance of good oral health care on the management of DM.

4.2.4 Awareness about oral health complications related to T2DM

Table (4.8). Participants' Awareness on oral health complications from T2DM (n = 376)

Awareness on oral health complications related to T2DM items	**Correct**		**Incorrect**	
	n	**%**	**n**	**%**
Diabetic patients require to care more often than non-diabetics for their teeth and mouth	352	93.6	24	6.4
Regular dental visit is more important for diabetic patients than non-diabetics.	342	91	34	9
Diabetics have gum problems more often if their blood sugar is uncontrolled	239	63.6	137	36.4
Oral problems associated with diabetes (prompted) :				
Mouth dryness	304	80.9	72	19.1
Gums bleeding on brushing•	185	49.2	191	50.8
Mouth ulcers	152	40.4	224	59.6
Bad odor	153	40.7	223	59.3
Dental caries	279	74.2	97	25.8
Oral bacterial infections.	142	37.8	234	62.2
Fungal mouth infections	157	41.8	219	58.2
Loose teeth	308	81.9	68	18.1
Taste problems	97	25.8	279	74.2
Burning sensation	99	26.3	277	73.7
Smoker diabetics have less serious gum disease than non-smokers. *	304	80.9	72	19.1
T2DM causes delayed wound healing at dental extraction sites	282	75	94	25
T2DM contributes more to developed dental abscess	165	43.9	211	56.1
as a diabetic, poor oral health condition affects badly the general health status	339	90.2	37	9.8
Total	57.61		42.39	

Table 4.8 shows that 57.6% of participants are aware and give correct answer about oral complications resulted from T2DM, whereas 42.4% give incorrect answer. Majority (91%) confirm the need for regular dental visit and "diabetic patients require to care more often than non-diabetics for their teeth and mouth" (93.6%). In return, above one third (36.4%) provide incorrect answer for the statement "Diabetics have gum problems more often if their blood sugar is uncontrolled". There are variations in the answer of participated patients regarding oral manifestations of T2DM. Most patients are not aware that taste problem and oral burning sensation could result from T2DM (74.2% and 73.7%, respectively). Moreover,

almost 60% of patients are not also aware that T2DM results in oral bacterial and fungal infection, mouth ulcer and bad mouth odor.

Lack of oral health knowledge, poor attitudes were also reported in the literature (El-Ashkar et al., 2019; Poudel et al., 2021). In Saudi Arabia, 63.4% of participants were aware of the effect of DM on oral health, 82.7% were aware about the need of diabetic patients for specialized healthcare (Mian et al., 2020). In Saudi Arabia, diabetic patients are aware about importance of controlling their diabetes in order to minimize oral health complication, but only very few of them visits the dentist regularly. Additionally, awareness of T2DM patients around oral diseases and complications is low compared to their knowledge of systematic diseases (Eldarrat, 2011).

In return, Ismail and Ali (2013) found low level of awareness among Saudis. Variation within the same country could be attributed to limited educational campaigns and weakness of their primary health facilities, especially in remote areas. Paurobally et al. (2020) found DM patients are aware of the association between DM and common systematic diseases, however, knowledge about oral complications of diabetes was limited (caries [29%], periodontal disease [37%], and xerostomia [52%]). Predictors for awareness of complications are education level and years since diagnosis of DM.

4.2.5 Oral health practices

Table (4.9) distribution participants' responses regarding oral health practices (n = 376)

Oral health practices items	Never n(%)	Rare n(%)	Sometime n(%)	Often n(%)	Always n(%)	M	SD	% mean
I brush my teeth twice a day	67 (17.8)	62 (16.5)	84 (22.3)	69 (18.4)	94 (25)	2.33	1.34	58.25
I brush my teeth for at least two minutes each time	62 (16.5)	44 (11.7)	77 (20.5)	84 (22.3)	109 (29)	2.47	1.35	61.75
I use toothbrush and paste to clean my teeth	25 (6.6)	24 (6.4)	61 (16.2)	37 (9.9)	229 (60.9)	3.18	1.18	79.50
I follow the vertical technique of brushing the teeth	66 (17.6)	35 (9.3)	101 (26.9)	52 (13.8)	122 (32.4)	2.44	1.40	61.00
I used to change toothbrush four times a year	50 (13.3)	40 (10.6)	76 (20.3)	41 (10.9)	169 (44.9)	2.74	1.38	68.50
I use mouthwash to preserve and keep my gum healthy	215 (57.2)	81 (21.5)	46 (12.2)	15 (4)	19 (5.1)	1.00	1.24	25.00
I remove interdental debris using dental floss or toothpick once a day	167 (44.4)	89 (23.7)	52 (13.8)	23 (6.1)	45 (12)	1.41	1.41	35.25
I clean my tongue	224 (59.6)	39 (10.4)	59 (15.7)	16 (4.2)	38 (10.1)	1.05	1.39	26.25
Using Silica Powder for tooth cleaning	338 (89.9)	18 (4.8)	12 (3.1)	1 (0.3)	7 (1.9)	0.24	0.76	6.00
Using Miswak for tooth cleaning	224 (59.6)	69 (18.4)	54 (14.3)	14 (3.7)	15 (4)	0.93	1.20	23.25
Using finger and paste for tooth cleaning	286 (76.1)	19 (5.1)	43 (11.4)	17 (4.5)	11 (2.9)	0.58	1.09	14.50
Using rinse with salty water for tooth cleaning	105 (27.9)	51 (13.6)	110 (29.2)	63 (16.8)	47 (12.5)	1.86	1.33	46.50
Using rinse with herbs for tooth cleaning	236 (62.8)	50 (13.3)	53 (14.1)	17 (4.5)	20 (5.3)	0.90	1.25	22.50
Using rinse with water only for tooth cleaning	15 (4)	9 (2.4)	79 (21)	50 (13.3)	223 (59.3)	3.24	1.06	81.00
I used to visit a dentist, for checkup, twice a year	180 (47.9)	94 (25)	45 (12)	25 (6.6)	32 (8.5)	1.28	1.34	2.00
Total						**1.71**	**0.52**	**42.5**

M: mean, SD: standard deviation

The mean score for oral health practices is 1.71(0.17) on five-point Likert scale, giving that 42.5% only are committed to best oral hygiene care. Majority (81% and 79.5%) of patient clean the mouth and teeth through rising with water only and toothbrush with paste, respectively. In another side, 58.25% brush their teeth twice a day and 61.75% do brush teeth at least two minutes each time. Two thirds (68.5%) change their toothbrush four times a year, and one third (32%) do visit a dentist, for checkup, twice a year (Table 4.9).

From the qualitative study, most interviewed patients do brush their teeth with toothpaste twice daily. Few used medical mouth wash, however based on medical advice. Other have used salty water to relief pain from gum. One patient stated that brushing teeth is based on his mood status.

"...I rinse my mouth every day 3 times and brush my teeth after meal and before bed..." (Male,Khanunis,63 years)

"...I just clean my teeth with water..." (Female,Khanunis,72 years)

These findings are comparable with relevant literature. Our results are better than findings from China, in which 22% only did brush the teeth twice daily (Aggarwal & Panat, 2012). Similarly, Kamath et al. (2015) had end with same findings. In England, most respondents (79.8%) had visited s dentist once or twice a year and 67% did brush their teeth at least twice, whereas, 15% did floss their teeth (Bowyer et al., 2011).

In the Arabic setting of Saudi Arabia, Al Amassi et al. (2017) found 45.6% of respondents brush their teeth once daily, 10.4% floss once daily, and only 11.5% use mouthwash regularly. Paurobally et al. (2022) reported that Mauritians are more than twice as likely to visit their dental care provider at least once annually. A study conducted by Slam and her colleagues (2021) found half of diabetic patients follow tooth brushing twice a day, and most patients either visit when necessary or never visited the dentist. A call for interprofessional education and interprofessional collaborative care was raised by Siddiqi et al. (2020) after finding 61% of participants reported brushing their teeth twice a day.

Kanjirath and her colleagues (2011) surveyed 448 Americans about importance of oral health related behaviors and found patients with diabetes brushed and flossed less frequently. Patients with diabetes who did not brush regularly had poorer periodontal health.

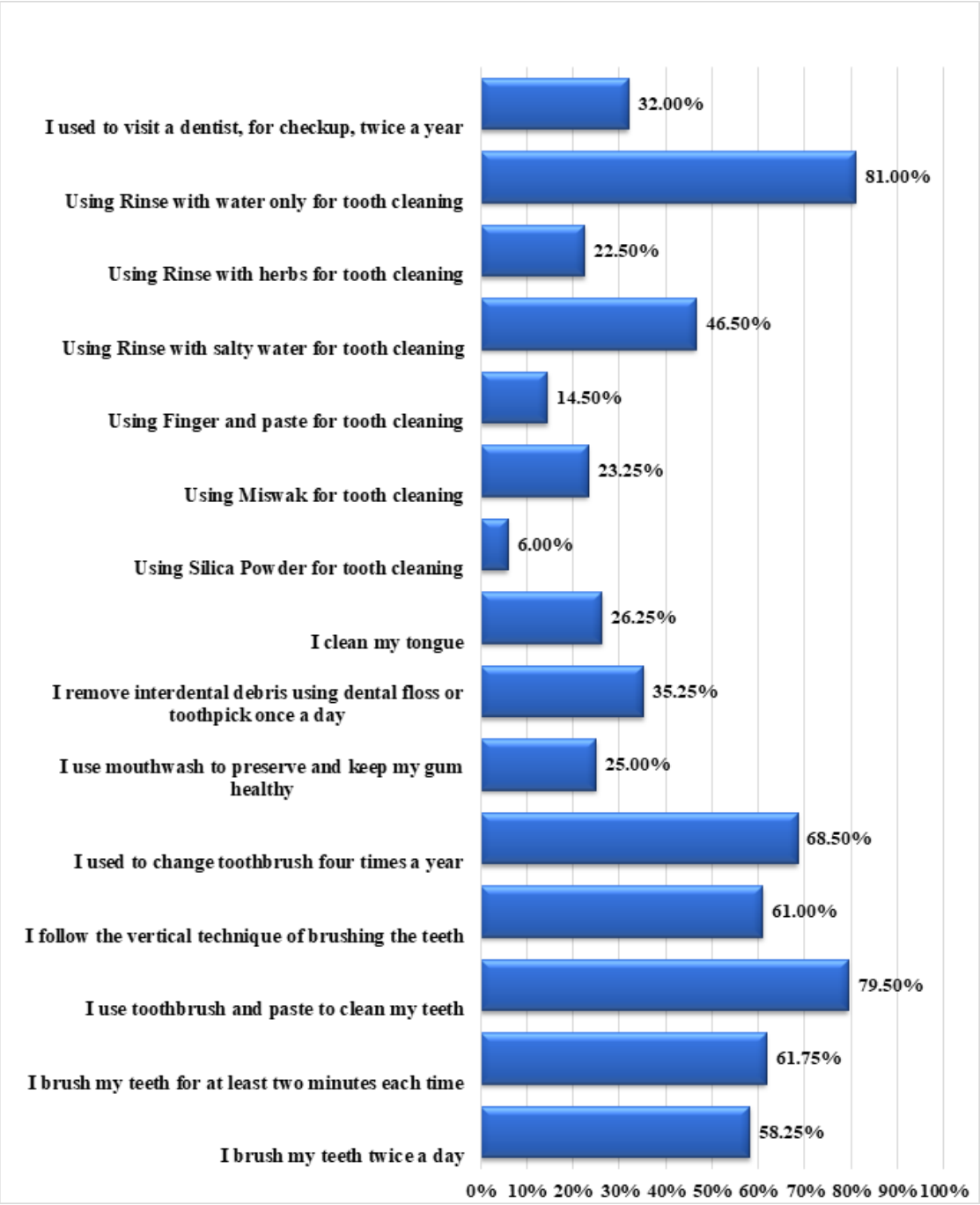

Figure (4.3): Distribution participants' responses regarding oral health practices (n = 376)

4.2.6 Oral health status

4.2.6.1 Dental status

Table (4.10): Distribution of the study participants according to dentition status

Crown	Sum	M	Median	SD
0 = Sound	5719	15.21	15.00	6.63
1 = Caries	2158	5.74	5.00	4.49
2 = Filled w/caries	205	0.55	0.00	1.15
3 = Filled, no caries	340	0.90	0.00	1.47
4 = Missing due to caries	1959	5.22	4.00	4.20
5 = Missing for any another reason	295	0.78	0.00	2.12
6 = Fissure sealant	0	0.00	0.00	0.00
7 = Fixed dental prosthesis/crown abutment, veneer, implant	1118	2.97	0.00	4.66
8 = Unerupted	131	0.35	0.00	0.97
9 = Not recorded	107	0.28	0.00	0.94

M: mean, SD: standard deviation

The mean DMFT is 13.18±6.39. Table (4.10) shows that the mean number of decayed teeth is 5.74±4.49, whereas the mean number of missed teeth due to caries is high (5.22±4.20) and 0.78±2.12 is the mean of missed teeth due to other reasons but not caries. Moreover, the mean number of filled teeth with caries appears to be very low (0.55±1.15).

From the qualitative study, most interviewed patient suffer from many dental and gum problems including dental caries, mobility and loss. Five patients lost all teeth and few didn't have oral and dental problems. Few (two patients) complained from bad mouth odor and ulceration.

"...I haven't any teeth at my mouth, all are falling..." (Male,Khanunis,58 years;Female,Khanunis,72 years;Male,Khanunis,64 years)

"...my teeth was prosthetic ,all are bad..." (Male,Khanunis,63 years)

"...from two months ago I went to dentist and he said to me that your teeth are good..." (Female,Gaza,63 years)

"...most of my teeth are mobile ..." (Femal,Khanunis,54 years)

"…my teeth and gum are good and I just need a restoration…" (Male,Gaza,47 years)

"…I extracted more than one tooth after I am diagnosed with diabetic disease …" (Female,Gaza,60 years)

The findings are consistent with a study conducted by Ribeiro et al. (2022) who found significant higher dental caries among patients with T2DM using the DMF-S (RR = 1.37; 95% CI = 1.09–1.71). In the United states, The mean number of missing teeth was 10.1 ± 7.2 (Simon et a., 2020). Hintao et al. (2007) compared root surface caries, number of decayed/filled root surfaces, and periodontitis between patients with T2DM and non-diabetic patients. The prevalence was higher and significant among T2DM (40.0% vs 18.5%; 1.2 vs 0.5; and 98.1% vs 87.4%, respectively). Dental caries was also seen to be higher amongT2DM patients with irregular brushing teeth compared to whom are regularly brushing (32% vs.15%, respectively) (Kanjirath et al., 2011). From Palestine, a study was conducted in West bank by Kateeb et al. (2015) among 370 diabetic patients, and the mean DMFT was 9±0.5.

These findings suggest that dental health care system in the Gaza Strip focuses on radical teeth treatment in term of tooth extraction and reflects the lack of participants' interest in the treatment of decayed teeth. Scientifically, many reasons are attributed to high dental caries, filling or missing especially with DM including dry mouth and salivary dysfunction which result in reduction of salivary flow rate, lower buffer capacity and high susceptibility to bacterial infection (Al-Maskari et al., 2011). Common bacteria link to dental caries are *Streptococcus mutans* and *Lactobacillus* have the ability to create a low pH environment and progression of caries (Chase et al., 2004).

4.2.6.2 Periodontal status

Table (4.11) Distribution of the study population according to periodontal status (n = 376)

Periodontal status	N	%	Median	M±SE
Gingival bleeding			2	5.12±0.34
Yes	82	21.8		
No	294	78.2		
Pocket			1	3.97±0.28
Yes	58	15.4		
No	318	84.6		
Loss attachment			2	1.88±0.04
0_3 mm	122	32.4		
4_5 mm	167	44.4		
6_8 mm	60	16.0		
9_11 mm	18	4.8		
12 mm or more	9	2.4		
Total	**376**	**100.0**		

Table (4.12) Severity of loss of attachment

Loss of attachment	Frequency	Percent
Slight	122	32.4
Moderate	167	44.4
Sever	87	23.2
Total	**376**	**100.0**

Table (4.11) presents periodontal status in terms of presence or absence of gingival bleeding, pocket, and loss of attachment. The median teeth with loss of attachment is 1.88±0.04. Severe loss of attachment is presented in 23.2% of participants (87/376), whereas, slight and moderate is found in 32.4% and 44.4%, respectively (Table 4.12). With regard to gingival bleeding, 82 (21.8%) patients show to have gingival bleeding with median 5.12±0.34 Additionally, 58 patients out of 376 (15.4%) have periodontal pocket with median 3.97±0.28 (Table 4.11). According to diagnostic criteria which measure severity of periodontitis, three signs of periodontal status with 25% of teeth for every patients should have signs of gingival bleeding, pocket depth and loss of attachment level. Severe periodontitis is diagnosed when at least 2 teeth of each quadrant have pocket depth ≥5mm with CLA ≥5mm and bleeding on probing. In return, moderate periodontitis means the pocket depth ≥4mm with CLA ≥3mm and bleeding on probing. Mild periodontitis means pocket depth ≥4mm with CLA ≥1mm and bleeding on probing, and no periodontitis status is when individual not enclosed in the previous groups (Gomes-Filho et al., 2018). Regarding to the WHO assessment sheet which

was used in dental examination, majority of participants have no periodontitis (160/376; 42.6%). In return, 8.5%, 21.5% and 27.4% of patients present with severe (32/376), moderate (81/376) and mild periodontitis (103/376), respectively (Figure 4.4).

These results are in line with several global studies. Rajhanset et al. (2011) and Barrientos et al. (2019) showed that periodontitis is highly prevalent among diabetic patients. Moreover, it is more severe than non-diabetics (Khader et al., 2006; Radebe, 2009). An old study conducted by Bacic and his colleagues (1998) revealed that missing teeth are high among diabetic patients and pathological pockets (≥ 6 mm) was significantly higher in diabetic than non-diabetic patients. Moderate periodontitis, measured by The Picture of Periodontal status (PSR) index ≥4, was noticed in 68% of diabetic patients (Simon et al., 2020). Individuals with diabetes are three time risky for periodontitis than those without diabetes, however, the risk is much lower among patients live with controlled T2DM (Alpert, 2017).

The relationship between diabetes and periodontitis is truly bidirectional, as it is well proven that hyperglycemia negatively impacts oral health through overproduction of the advanced glycation end product (AGE) (Kuo et al., 2008), and severe periodontitis can negatively impact glycemic control (Garton et al., 2012). Advanced glycation end products have a systemic impact that results in over excretion of cytokines leading to local oral inflammation and a loss of dental connective tissue (Amar & Hans, 2003). Gingival pockets that are deeper than 4 mm are more common in diabetics than nondiabetics, and patients with pockets greater than 2 mm deep are at an increased risk of diabetes compared to patients with pockets less than 1.3 mm deep (Scannapieco, 2005).

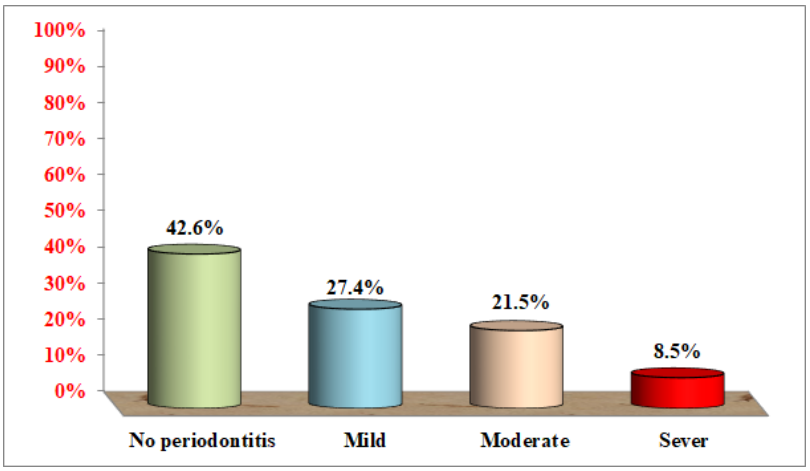

Figure (4.4): Severity of periodontitis

4.3 Inferential statistics

4.3.1 Mean differences of HBM, awareness and practices according to socio-demographic characteristics

4.3.1.1 Variations according to gender

Table (4.13): Mean differences of HBM, awareness and practices according to gender (n = 376)

Domains	Gender	n	M	SD	T	P-value
Perceived susceptibility to oral complications (Max=5)	Male	169	3.24	0.31	1.367	0.173
	Female	207	3.20	0.33		
Perceived severity of oral complications (Max=5)	Male	169	3.26	0.49	-5.368	0.000**
	Female	207	3.50	0.39		
Perceived benefits from oral health practices (Max=5)	Male	169	3.65	0.29	-0.443	0.658
	Female	207	3.66	0.26		
Perceived barriers to oral health practices (Max=5)	Male	169	2.73	0.32	-3.874	0.000**
	Female	207	2.87	0.37		
Awareness on oral health complications related to T2DM (Max=100)	Male	169	55.19	18.28	-2.317	0.021
	Female	207	59.58	18.26		
Oral health practices (Max=4)	Male	169	1.68	0.53	-1.150	0.251
	Female	207	1.74	0.50		

M: mean, SD: standard deviation; **: $P < 0.001$

Table (4.13) presents mean variations between males and females with regard to HBM, patients' awareness and oral health practices. Females have high mean compared to males, and statistical significant is noticed with perceived severity of oral complications, barriers to oral hygiene practice and awareness of oral complications resulted from T2DM ($P < 0.05$).

From the researcher point of view, these findings could be explained from many sides. First, most females are housewives and 91% of households have access to internet at home and at

least one smart phone is available at home (PCBS, 2022). Thus, females use more internet than males and are lucky to access websites that provide plenty of information on DM and proper oral hygiene. Furthermore, females are known to use more health services than males and so they do expose to health information given at PHCs. Additionally, females are also known to like beauty and imitation of stars and they o like to take care of themselves in comparison to males who are busy at work.

4.3.1.2 Variations according to age

Table (4.14): Mean differences of HBM, awareness and practices according to age (n = 376)

Domain	Age	n	M	SD	F	P-value
Perceived susceptibility to oral complications (Max=5)	50 or less	84	3.21	0.36	1.170	0.324
	51-55	69	3.20	0.32		
	56-60	75	3.27	0.30		
	61-65	70	3.16	0.32		
	More than 65	78	3.25	0.30		
	Total	376	3.22	0.32		
Perceived severity of oral complications (Max=5)	50 or less	84	3.51	0.40	3.297	0.011*
	51-55	69	3.41	0.39		
	56-60	75	3.38	0.47		
	61-65	70	3.40	0.46		
	More than 65	78	3.25	0.50		
	Total	376	3.39	0.45		
Perceived benefits from oral health practices (Max=5)	50 or less	84	3.72	0.28	1.496	0.203
	51-55	69	3.66	0.27		
	56-60	75	3.63	0.30		
	61-65	70	3.64	0.28		
	More than 65	78	3.64	0.24		
	Total	376	3.66	0.28		
Perceived barriers to oral health practices (Max=5)	50 or less	84	2.83	0.36	0.748	0.560
	51-55	69	2.75	0.34		
	56-60	75	2.82	0.36		
	61-65	70	2.84	0.38		
	More than 65	78	2.79	0.33		
	Total	376	2.81	0.36		
Awareness on oral health complications related to T2DM (Max=100)	50 or less	84	62.24	18.39	2.002	0.094
	51-55	69	54.43	17.66		
	56-60	75	56.67	17.28		
	61-65	70	56.35	20.09		
	More than 65	78	57.48	17.90		
	Total	376	57.61	18.37		
Oral health practices (Max=4)	50 or less	84	11.20	3.31	2.002	0.094
	51-55	69	9.80	3.18		
	56-60	75	10.20	3.11		
	61-65	70	10.14	3.62		
	More than 65	78	10.35	3.22		
	Total	376	10.37	3.31		

M: mean, SD: standard deviation, *: $P < 0.05$

The mean of oral hygiene practices is high in the age group less than 50 years old and decreases accordingly. Similarly, the awareness regarding oral manifestations and perception regarding benefits of oral hygiene are better in the age group less than 50 years old. However, they are not statistically significant ($P > 0.05$). Mean perception of severity of oral complications is also better in the age group less than 50 years old and is statistically significant ($P < 0.05$). Post-hoc test, using Bonferoni test, was performed with perceived severity and significancy is noticed between age group less than 50 years and above 65 years old groups ($P < 0.05$) (Table 4.14 and Annex 12.2).

Participants under the age of fifty seem to be committed to good oral health habits. As they still have the ability to take better care of their oral health than older people, this might be a powerful motivator for health educators and clinicians to act and emphasize the importance of oral hygiene. Furthermore, they are more aware of oral problems than older people are, which may explain why they are younger. Younger people can also access the internet and visit medical facilities more frequently to receive care, which allows them to learn more about their health than older people who are unable to do so due to poor mobility and other conditions that worsen with age.

4.3.1.3 Variations according to place of residence

Table (4.15): Mean differences of HBM, awareness and practices according to place of residence (n = 376)

	Residence	**N**	**M**	**SD**	**F**	**P-value**
Perceived susceptibility to oral complications (Max=5)	North Gaza	48	3.15	0.21	9.568	0.000**
	Gaza city	199	3.26	0.32		
	Middle zone	31	3.44	0.20		
	Khan Younis	73	3.07	0.36		
	Rafah	25	3.20	0.30		
	Total	376	3.22	0.32		
Perceived severity of oral complications (Max=5)	North Gaza	48	3.51	0.16	5.802	0.000**
	Gaza city	199	3.43	0.44		
	Middle zone	31	3.18	0.31		
	Khan Younis	73	3.41	0.55		
	Rafah	25	3.09	0.52		
	Total	376	3.39	0.45		

Table (4.15): Continued

Perceived benefits from oral health practices (Max=5)	North Gaza	48	3.60	0.03	46.834	0.000**
	Gaza city	199	3.63	0.20		
	Middle zone	31	3.27	0.27		
	Khan Younis	73	3.89	0.28		
	Rafah	25	3.81	0.36		
	Total	376	3.66	0.28		
Perceived barriers to oral health practices (Max=5)	North Gaza	48	2.78	0.26	7.006	0.000**
	Gaza city	199	2.89	0.34		
	Middle zone	31	2.66	0.25		
	Khan Younis	73	2.75	0.45		
	Rafah	25	2.59	0.32		
	Total	376	2.81	0.36		
Awareness on oral health complications related to T2DM (Max=100)	North Gaza	48	50.35	9.41	19.110	0.000**
	Gaza city	199	56.53	17.30		
	Middle zone	31	42.11	14.75		
	Khan Younis	73	67.20	19.56		
	Rafah	25	71.33	17.62		
	Total	376	57.61	18.37		
Oral health practices (Max=4)	North Gaza	48	1.52	0.43	5.319	0.000**
	Gaza city	199	1.66	0.54		
	Middle zone	31	1.80	0.43		
	Khan Younis	73	1.85	0.46		
	Rafah	25	1.96	0.55		
	Total	376	1.71	0.52		

M: mean, SD: standard deviation, **: $P < 0.001$

There is a statistically differences between HBM, patients' awareness, oral health practices and place of residence; North Gaza ,Gaza city, Middle zone, Khan Younis and Rafah ($P < 0.0001$). The mean perception of susceptibility to oral complication and oral hygiene practices are high among patients from middle zone area ($P < 0.001$). In return, perceived severity is high in patient's resident in the north of Gaza ($P < 0.001$), Whereas perceived benefits and barriers to oral hygiene are high in patient's resident in Gaza city ($P < 0.001$) (Table 4.15). Differences could be attributed to variety of culture of different geographical areas .

4.3.1.4 Variations according to education level

Table (4.16): Mean differences of HBM, awareness and practices according to education level (n = 376)

Domain	Education	n	M	SD	F	P-value
Perceived susceptibility to oral complications (Max=5)	Illiterate	24	3.13	0.36	1.655	0.160
	Up to elementary school	65	3.22	0.28		
	Up to preparty school	104	3.23	0.32		
	Up to secondary school	113	3.26	0.36		
	University and above	70	3.16	0.29		
	Total	376	3.22	0.32		
Perceived severity of oral complications (Max=5)	Illiterate	24	3.43	0.37	0.985	0.416
	Up to elementary school	65	3.40	0.44		
	Up to preparty school	104	3.44	0.41		
	Up to secondary school	113	3.39	0.48		
	University and above	70	3.31	0.51		
	Total	376	3.39	0.45		
Perceived benefits from oral health practices (Max=5)	Illiterate	24	3.54	0.26	2.889	0.022*
	Up to elementary school	65	3.63	0.26		
	Up to preparty school	104	3.63	0.27		
	Up to secondary school	113	3.69	0.25		
	University and above	70	3.72	0.32		
	Total	376	3.66	0.28		
Perceived barriers to oral health practices (Max=5)	Illiterate	24	2.83	0.30	0.402	0.807
	Up to elementary school	65	2.80	0.38		
	Up to preparty school	104	2.78	0.36		
	Up to secondary school	113	2.81	0.37		
	University and above	70	2.85	0.33		
	Total	376	2.81	0.36		
Awareness on oral health complications related to T2DM (Max=100)	Illiterate	24	53.24	16.21	0.703	0.590
	Up to elementary school	65	59.66	21.32		
	Up to preparty school	104	58.55	16.87		
	Up to secondary school	113	56.54	18.31		
	University and above	70	57.54	18.51		
	Total	376	57.61	18.37		
Oral health practices (Max=4)	Illiterate	24	1.61	0.43	4.298	0.002*
	Up to elementary school	65	1.53	0.48		
	Up to preparty school	104	1.73	0.45		
	Up to secondary school	113	1.71	0.54		
	University and above	70	1.88	0.57		
	Total	376	1.71	0.52		

M: mean, SD: standard deviation, *: $P < 0.05$

There is no statistical differences between education level and perceived susceptibility to oral complications, perceived severity of oral complications, perceived barriers to oral health practices, and awareness on oral health complications related to T2DM (P > 0.05). In return, statistical significance is noticed between level of educations and perceived benefits from oral health practices and Oral health practices (P > 0.05) . The mean perception of benefits from oral health practices and oral hygiene practices are high in patients who completed at least a university degree (Table 4.16). Patients with higher levels of education (graduate and postgraduate) showed significant better brushing habits and more awareness regarding oral health problems from diabetes in comparison with those with low levels of education (Al Amassi et al., 2017).

4.3.1.5 Variations according to marital status

Table (4.17): Mean differences of HBM, awareness and practices according to marital status

Domain	Marital status	n	M	SD	t	P-value
Perceived susceptibility to oral complications (Max=5)	Unmarried	62	3.20	0.28	-0.525	0.600
	Married	314	3.22	0.33		
Perceived severity of oral complications (Max=5)	Unmarried	62	3.48	0.48	1.681	0.094
	Married	314	3.37	0.44		
Perceived benefits from oral health practices (Max=5)	Unmarried	62	3.68	0.22	0.574	0.566
	Married	314	3.66	0.29		
Perceived barriers to oral health practices (Max=5)	Unmarried	62	2.88	0.33	1.777	0.076
	Married	314	2.79	0.36		
Awareness on oral health complications related to T2DM (Max=100)	Unmarried	62	57.80	17.49	0.087	0.930
	Married	314	57.57	18.57		
Oral health practices (Max=4)	Unmarried	62	1.62	0.53	-1.579	0.115
	Married	314	1.73	0.51		

M: mean, SD: standard deviation

There is no statistical differences between marital status and the four constructs of the HBM: perceived susceptibility to, severity of oral complications, perceived benefits from, and barriers to oral hygiene (P > 0.05). Whereas, awareness on oral health complications related to T2DM and oral health practices are not statistically significant (P > 0.05) (Table 4.17).

4.3.1.6 Variations according to income level

Table (4.18): Mean differences of HBM, awareness and practices according to income level

Domain	Income (NIS)	N	M	SD	t	P-value
Perceived susceptibility to oral complications (Max=5)	≤ 1974	314	3.23	0.32	1.246	0.213
	> 1974	62	3.17	0.31		
Perceived severity of oral complications (Max=5)	≤ 1974	314	3.41	0.45	2.068	0.039*
	> 1974	62	3.28	0.47		
Perceived benefits from oral health practices (Max=5)	≤ 1974	314	3.66	0.27	-0.574	0.566
	> 1974	62	3.68	0.29		
Perceived barriers to oral health practices (Max=5)	≤ 1974	314	2.80	0.36	-0.756	0.450
	> 1974	62	2.84	0.33		
Awareness on oral health complications related to T2DM (Max=100)	≤ 1974	314	57.77	18.46	0.374	0.708
	> 1974	62	56.81	18.03		
Oral health practices (Max=4)	≤ 1974	314	1.68	0.51	-2.563	0.011*
	> 1974	62	1.86	0.55		

M: mean, SD: standard deviation, *: $P < 0.05$

Statistical differences are noticed between income level and perceived severity from oral complications and oral health practices ($P < 0.01$). The mean score is higher among patients who have income above 1974 NIS (Table 4.18).

A meta-analysis conducted by Singh, Peres, and Watt (2019) revealed inequalities in oral health status with patients having different socio-economic situations. Patients with low household income are at high risk for oral cancer, dental caries prevalence, tooth loss, traumatic dental injuries, periodontal disease and poor oral health-related quality of life. Theoretically, this is logic because individuals who live under poverty line are unable to meet basic family requirements and needs. Additional requirements for instance oral hygiene could simply be categorized as unnecessary practices, although they perceived its importance. Blackwell et al. (2014) stated that income affects the likelihood of using dental services and people with higher income reported a higher dental service use Additionally, individuals with low income have a higher likelihood of delayed or missed dental care (Roberts-Thomson et al, 2011).

4.3.1.7 Variations with regard to working status

Table (4.19): Mean difference of HBM, awareness and oral health practices with regard to working status.(n = 376)

Domains	Working status	N	M	SD	t	P-value
Perceived susceptibility to oral complications (Max=5)	Working	102	3.22	0.33	-0.104	0.917
	Not Working	274	3.22	0.32		
Perceived severity of oral complications (Max=5)	Working	102	3.31	0.45	-2.191	0.029
	Not Working	274	3.42	0.45		
Perceived benefits from oral health practices (Max=5)	Working	102	3.67	0.29	0.579	0.563
	Not Working	274	3.65	0.27		
Perceived barriers to oral health practices (Max=5)	Working	102	2.76	0.29	-1.620	0.106
	Not Working	274	2.83	0.38		
Oral health practices (Max=4)	Working	102	1.62	0.58	-2.149	0.032*
	Not Working	274	1.74	0.49		
Awareness on oral health complications related to T2DM	Working	102	9.78	3.02	-2.104	0.036*
	Not Working	274	10.59	3.39		

M: mean, SD: standard deviation, *: $P < 0.05$

There is statistically differences between working status and oral health practices, awareness on oral health complications related to T2DM, and perceived severity of oral complications ($P < 0.05$). Whereas no statistical differences are noticed with the remained constructs of the HBM ($P > 0.05$) (Table 4.19). A possible explanation is that working participants didn't have time to commit to caring for their teeth by practicing good oral hygiene, nor did they have time to advance their knowledge of oral hygiene.

4.3.2 Mean differences of HBM, awareness and oral health practices according to clinical characteristics

4.3.2.1 Variations according to duration of having T2DM.

Table (4.20): Mean differences of HBM, awareness and oral health practices with regard to duration of T2DM (n = 376).

Domain	Duration age	N	M	SD	t	P-value
Perceived susceptibility to oral complications (Max=5)	10 or less	241	3.22	0.33	0.056	0.955
	More than 10	135	3.22	0.31		
Perceived severity of oral complications (Max=5)	10 or less	241	3.47	0.40	4.380	0.000**
	More than 10	135	3.26	0.50		
Perceived benefits from oral health practices (Max=5)	10 or less	241	3.68	0.28	1.709	0.088
	More than 10	135	3.63	0.26		
Perceived barriers to oral health practices (Max=5)	10 or less	241	2.82	0.37	1.150	0.251
	More than 10	135	2.78	0.34		
Awareness on oral health complications related to T2DM (Max=100)	10 or less	241	59.59	18.91	2.818	0.005*
	More than 10	135	54.07	16.86		
Oral health practices (Max=4)	10 or less	241	1.73	0.51	0.901	0.368
	More than 10	135	1.68	0.52		

M: mean, SD: standard deviation, **: $P < 0.001$, *: $P < 0.05$

The mean score of HBM, except for perception of susceptibility, and awareness about oral complications are better for patients who have T2DM for 10 years or less, however, statistically significant is only noticed with perceived severity to and awareness about oral complication ($P < 0.001$). In return, the mean score of oral health practices is better, but not significant, for patients having T2DM above 10 years ($P > 0.05$) (Table 4.20).

4.3.2.2 Variations with regard to family history of oral complications

Table (4.21): Mean differences of HBM, awareness and oral health practices with regard to family history of oral complications (n = 376).

Domain	Family history of oral complications from T2DM	n	M	SD	t	P-value
Perceived susceptibility to oral complications (Max=5)	Yes	186	3.30	0.28	4.967	0.000**
	No	190	3.14	0.34		
Perceived severity of oral complications (Max=5)	Yes	186	3.40	0.43	0.504	0.614
	No	190	3.38	0.48		
Perceived benefits from oral health practices (Max=5)	Yes	186	3.65	0.25	-0.666	0.506
	No	190	3.67	0.30		
Perceived barriers to oral health practices (Max=5)	Yes	186	2.83	0.35	1.048	0.295
	No	190	2.79	0.36		
Awareness on oral health complications related to T2DM (Max=100)	Yes	186	58.81	17.35	1.256	0.210
	No	190	56.43	19.29		
Oral health practices (Max=4)	Yes	186	1.65	0.51	-2.165	0.031*
	No	190	1.77	0.52		

M: mean, SD: standard deviation, **: $P < 0.001$, *: $P < 0.05$

The mean score of HBM and awareness on oral complications is better for patients who have family history with oral complications resulted from T2DM, however, statistically significant is noticed with perceived susceptibility only ($P < 0.0001$). In return, the mean score of oral health practices is better and significant for patients who have no family history of oral complications resulted from T2DM ($P < 0.05$) (Table 4.21).

Participants who believe they have a family history of oral difficulties are more likely to have oral complications connected to diabetes. Unfortunately, they did not make a commitment to adopting the finest dental hygiene practices in order to avoid or lessen these difficulties.

4.3.2.3 Variations with regard to previous education about oral care

Table (4.22): Mean differences of HBM, awareness and oral health practices with regard to previous education about oral care (n = 376)

Domain	Receiving education about oral care	n	M	SD	T	P-value
Perceived susceptibility to oral complications (Max=5)	Yes	78	3.19	0.29	-1.006	0.315
	No	298	3.23	0.33		
Perceived severity of oral complications (Max=5)	Yes	78	3.40	0.42	0.254	0.799
	No	298	3.39	0.46		
Perceived benefits from oral health practices (Max=5)	Yes	78	3.75	0.28	3.365	0.001*
	No	298	3.63	0.27		
Perceived barriers to oral health practices (Max=5)	Yes	78	2.77	0.34	-0.922	0.357
	No	298	2.82	0.36		
Awareness on oral health complications related to T2DM (Max=100)	Yes	78	58.26	17.22	0.352	0.725
	No	298	57.44	18.69		
Oral health practices (Max=4)	Yes	78	1.86	0.49	3.008	0.003*
	No	298	1.67	0.52		

M: mean, SD: standard deviation, *: $P < 0.05$

The mean score of awareness on oral complication and oral health practices are better for patients who had attended education session on oral care, but significance is noticed with the oral health practices ($P < 0.05$). With regard to the four constructs of the HBM, statistically significant is found with perceived benefits from oral hygiene ($P = 0.001$) (Table 4.22).

Thus, it follows that when people's awareness of oral complications is raised through oral care education sessions and their belief in the value of committing to the best oral health practices, their oral health practices will be enhanced. This is a logical conclusion.

4.3.2.4 Variations with regard to last reading of HBA1c

ThTable (4.23): Mean difference of HBM, awareness and oral health practices with regard to last reading of HBA1c (n = 376)

Domain	Last reading of HbA1c	n	M	SD	t	P-value
Perceived susceptibility to oral complications (Max=5)	≤ 7	143	3.24	0.32	1.184	0.237
	> 7	233	3.20	0.32		
Perceived severity of oral complications (Max=5)	≤ 7	143	3.36	0.49	-1.100	0.272
	> 7	233	3.41	0.43		
Perceived benefits from oral health practices (Max=5)	≤ 7	143	3.64	0.26	-0.941	0.347
	> 7	233	3.67	0.29		
Perceived barriers to oral health practices (Max=5)	≤ 7	143	2.81	0.37	0.279	0.781
	> 7	233	2.80	0.35		
Awareness on oral health complications related to T2DM (Max=100)	≤ 7	143	56.49	19.75	-0.927	0.355
	> 7	233	58.30	17.49		
Oral health practices (Max=4)	≤ 7	143	1.74	0.52	0.977	0.329
	> 7	233	1.69	0.52		

M: mean, SD: standard deviation

There is no statistically differences between last reading of HbA1c and the four HBM constructs, awareness on oral health complications related to T2DM and oral health practices (P > 0.05) (Table 4.23).

4.3.2.5 Variations with regard to other chronic diseases

Table (4.24): Mean difference of HBM, awareness and oral health practices with regard to other chronic diseases (n = 376)

Domain	Having other chronic diseases	n	M	SD	t	P-value
Perceived susceptibility to oral complications (Max=5)	Yes	236	3.21	0.33	-0.798	0.426
	No	140	3.24	0.32		
Perceived severity of oral complications (Max=5)	Yes	236	3.37	0.43	-1.232	0.219
	No	140	3.43	0.49		
Perceived benefits from oral health practices (Max=5)	Yes	236	3.65	0.25	-1.058	0.291
	No	140	3.68	0.32		
Perceived barriers to oral health practices (Max=5)	Yes	236	2.81	0.37	0.132	0.895
	No	140	2.80	0.33		
Awareness on oral health complications related to T2DM (Max=100)	Yes	236	57.58	18.33	-0.040	0.968
	No	140	57.66	18.51		
Oral health practices (Max=4)	Yes	236	1.67	0.52	-1.794	0.074
	No	140	1.77	0.51		

M: mean, SD: standard deviation

The mean score of HBM, except for perceived barriers to oral health practices, awareness and oral health practices are high pro patients have no other chronic diseases. However, no statistically significant is noticed ($P > 0.05$) (Table 4.24).

4.3.2.6 Mean difference of HBM, awareness and oral health practices with regard to suffering from oral diseases in the last year.

The mean Table (4.25): Mean difference of HBM, awareness and oral health practices with regard to suffering from oral diseases in the last year(n = 376)

Domain	Suffering from oral diseases in the last year	n	M	SD	t	P-value
Perceived susceptibility to oral complications (Max=5)	Yes	300	3.22	0.32	0.043	0.966
	No	76	3.22	0.35		
Perceived severity of oral complications (Max=5)	Yes	300	3.42	0.44	2.089	0.037
	No	76	3.30	0.50		
Perceived benefits from oral health practices (Max=5)	Yes	300	3.67	0.26	1.911	0.057
	No	76	3.61	0.32		
Perceived barriers to oral health practices (Max=5)	Yes	300	2.81	0.35	0.276	0.783
	No	76	2.80	0.37		
Awareness on oral health complications related to T2DM (Max=100)	Yes	300	58.83	17.83	2.586	0.010
	No	76	52.78	19.78		
Oral health practices (Max=4)	Yes	300	1.69	0.53	-1.589	0.113
	No	76	1.79	0.43		

M: mean, SD: standard deviation

Patients who reported oral diseases (tooth decay, tooth loss, infection, tooth mobility, bad odor,…) show better mean score with regard to the HBM, except perception of susceptibility, statistical significant is noticed with perceived severity and awareness on oral complications resulted from T2DM. In return, the mean score of oral health practices is pro patients who reported no oral diseases in the last year and the mean difference is not statistically significant (Table 4.25).

This indicates that participants with oral disease are more likely to believe in the seriousness of oral complications related to T2DM and are more knowledgeable about these

complications than participants without oral disease. They also tend to believe more strongly in the advantages of implementing the best oral hygiene practices.

4.3.2.7 Mean difference of HBM, awareness and oral health practices with regard to visiting dental clinic last year

Table (4.26): Mean difference of HBM, awareness and oral health practices with regard to visiting dental clinic last year (n = 376)

Domain	Visiting dental clinic last year	n	M	SD	t	P-value
Perceived susceptibility to oral complications (Max=5)	Yes	213	3.21	0.33	-0.662	0.509
	No	163	3.23	0.31		
Perceived severity of oral complications (Max=5)	Yes	213	3.42	0.47	1.302	0.194
	No	163	3.36	0.43		
Perceived benefits from oral health practices (Max=5)	Yes	213	3.71	0.26	4.014	0.000
	No	163	3.60	0.28		
Perceived barriers to oral health practices (Max=5)	Yes	213	2.82	0.37	1.057	0.291
	No	163	2.79	0.33		
Awareness on oral health complications related to T2DM (Max=100)	Yes	213	60.85	17.97	3.987	0.000
	No	163	53.37	18.09		
Oral health practices (Max=4)	Yes	213	1.75	0.54	1.656	0.099
	No	163	1.66	0.48		

M: mean, SD: standard deviation

of the HBM constructs, except for perception of susceptibility, awareness on oral complication and oral health practices are better pro patients who have visited dental clinics within last 12 months, and statistically significant is noticed with awareness, and perceived benefits from oral hygiene ($P < 0.001$) (Table 4.26).

And this means that people are visiting dental clinics for routine checkups to feel more confident about their oral health as awareness of oral complications related to T2DM increases and they believe there will be benefits to complementing current oral health practices.

4.3.2.8 Mean difference of HBM, awareness and oral health practices with regard to type of treatment

Table (4.27): Mean difference of HBM, awareness and oral health practices with regard to type of treatment (n = 376)

Domains	Type of treatment	n	M	SD	t	P-value
Perceived susceptibility to oral complications (Max=5)	Diet restriction and physical activity	18	3.33	0.24	1.555	0.121
	Hypoglycemic agents	358	3.21	0.32		
Perceived severity of oral complications (Max=5)	Diet restriction and physical activity	18	3.37	0.38	-0.252	0.801
	Hypoglycemic agents	358	3.39	0.46		
Perceived benefits from oral health practices (Max=5)	Diet restriction and physical activity	18	3.43	0.26	-3.617	0.000*
	Hypoglycemic agents	358	3.67	0.27		
Perceived barriers to oral health practices (Max=5)	Diet restriction and physical activity	18	2.79	0.47	-0.226	0.821
	Hypoglycemic agents	358	2.81	0.35		
Oral health practices (Max=4)	Diet restriction and physical activity	18	2.02	0.47	2.641	0.009*
	Hypoglycemic agents	358	1.69	0.51		
Awareness on oral health complications related to T2DM	Diet restriction and physical activity	18	9.33	3.14	-1.364	0.173
	Hypoglycemic agents	358	10.42	3.31		

M: mean, SD: standard deviation

There are no association between Perceived susceptibility to oral complications (p=0.121), Perceived severity of oral complications (p=0.801), Perceived barriers to oral health practice (p=0.821), and Awareness on oral health complications related to T2DM (p=0.173), While there are significant differences with Perceived benefits from oral health practices (p=0.000) and Oral health practices (p=0.009) according to type of treatment (Table 4.27).

4.3.3 Relationship between Dental ,periodontal status and socio-demographic characteristics.

4.3.3.1 Variations of DMFT of participants regarding to their socio-demographic characteristics.

Table (4.28): The mean differences of dentition status DMF related to socio-demographic data among study population (n = 376)

	(n=376)	DMF	(Max=32) M±SD DMFT	Statistical test	
				DMFTt/F	P-value
Age group					
≤ 50	84	1007	11.99±7.21	1.516	0.197
51-55	69	892	12.93±6		
56-60	75	1025	13.67±5.46		
61-65	70	915	13.07±5.99		
> 65	78	1118	14.33±6.85		
Gender					
Male	169	2368	14.01±6.58	2.268	0.024*
Female	207	2590	12.51±6.16		
Residency					
North Gaza	48	774	16.13±4.85	6.897	0.000**
Gaza city	199	2663	13.38±6		
Middle zone	31	383	12.35±5.89		
Khan Younis	73	764	10.47±7.1		
Rafah	25	373	14.92±7.47		
Smoker					
Yes	45	637	14.16±6.25	4.844	0.008*
No	292	3703	12.68±6.31		
Ex-smoker	39	617	15.82±6.5		
Level of education					
Illiterate	24	383	15.96±4.26	1.961	0.100
Up to elementary school	65	841	12.94±6.31		
Up to prepar school	104	1422	13.67±5.64		
Up to secondary school	113	1472	13.03±7.12		
University and above	70	839	11.99±6.67		
Marital status					
Unmarried	62	774	12.48±6.4	-0.944	0.346
Married	314	4182	13.32±6.39		
Number of family member					
≤ 5	102	1278	12.53±6.79	1.047	0.352
6-10	219	2906	13.27±6.23		
> 10	55	772	14.04±6.22		
Working status					
Working	102	1400	13.73 ±6.23	1.004	0.316
Not working	274	3556	12.98 ±6.45		
Income					
Under deep poverty line (Less than 1974 NIS)	314	1461	13.25±6.55	0.443	0.658
Above deep poverty line (1974 or more NIS)	62	797	12.85±5.52		

M: mean, SD: standard deviation

The mean of DMFT is found to be statistically significant with gender, place of residence, and smoking status ($P < 0.05$). The mean DMFT is higher in males, patients from north of Gaza, and among ex-smokers (Table 4.28). Post-hoc analysis, using Bonferoni test, shows significant differences pro ex-smokers with regard to DMFT ($P < 0.05$) (Annex 12.1).

Tobacco is a determinant for individual's health and is accountable for bad oral health status and many oral complications. Among these, dental caries is the most prevalent. Many studies approved positive association between smoking and development of dental caries except the longitudinal study of Bernarbe et al. (2014). Others have studied the effect of nicotine on presence of microbes in saliva. They concluded that presence of oral bacteria especially Streptococcus mutans is triggered by amount of nicotine (Chanea & Palmire, 2014; Mohammed et al., 2018; Ashkanane et al., 2017). The bacteria use sacrose for metabolism and its products are accused to cause dental caries. With regard to ex-smokers, the researcher thinks that individuals had quit smoking for many reasons including development of oral complications like caries, periodontitis and gum bleeding. It is not clear when smokers did quit smoking and after how long of smoking.

In return, the mean DMFT increases with age, however, it is not statistically significant (Figure 4.5). Illiterates, patient who live under poverty line and family size above 10 members are shown to have higher DMFT, but they are not statistically significant ($P > 0.05$).

Unlike these findings, a study conducted in Gaza strip by Alqedra and Aljeesh (2020) showed age, educational level, employment status and frequency of teeth brushing are statistically significant with DMFT. The researcher thinks that socio-demographic and economic status are interrelated and do interfere in complex manner on human's health. Unemployment could contribute to less oral hygiene practice because mandates for oral hygiene become unnecessary to human's life and interesting is shifting toward more important things in his and family life. Moreover, low education level is documented as a significant link to bad oral hygiene practices. Illiterate or low-level education contribute to low level of knowledge. It is well known that information gained do contribute to positive attitudes that maintain proper practices.

As a source of speculation, the researcher thinks that differences between her findings and findings of Alqedra and Aljeesh (2020), which was applied at UNRWA clinics, with regard to periodontal status is being related to type of examination performed. The study of Alqedra and Aljeesh (2020) did not examined loss of attachment, which is an important aspect of periodontitis.

Unlike our findings, age was a significant factor in many studies (Yi-hong cheng et al., 2019; Bernabé, Sheiham & Age, 2014). Additionally, females were more prone to decay, missing and filled teeth than their counterpart males (Benev, 2015; Shaffer et al., 2015). In line with the finding that high level of education is associated with better knowledge toward oral health practices, Bayraktar et al. (2009) had reached similar results among Turkish diabetes patients. Moroever, Johari et al. (2021) findings were consistent with ours' adding one more factors: presence of hypertension as a comorbidity (Leung et al., 2008). The DMF score was 9.4 and 2.9 in smokers and non-smokers, respectively (Ul Amin et al., 2021).

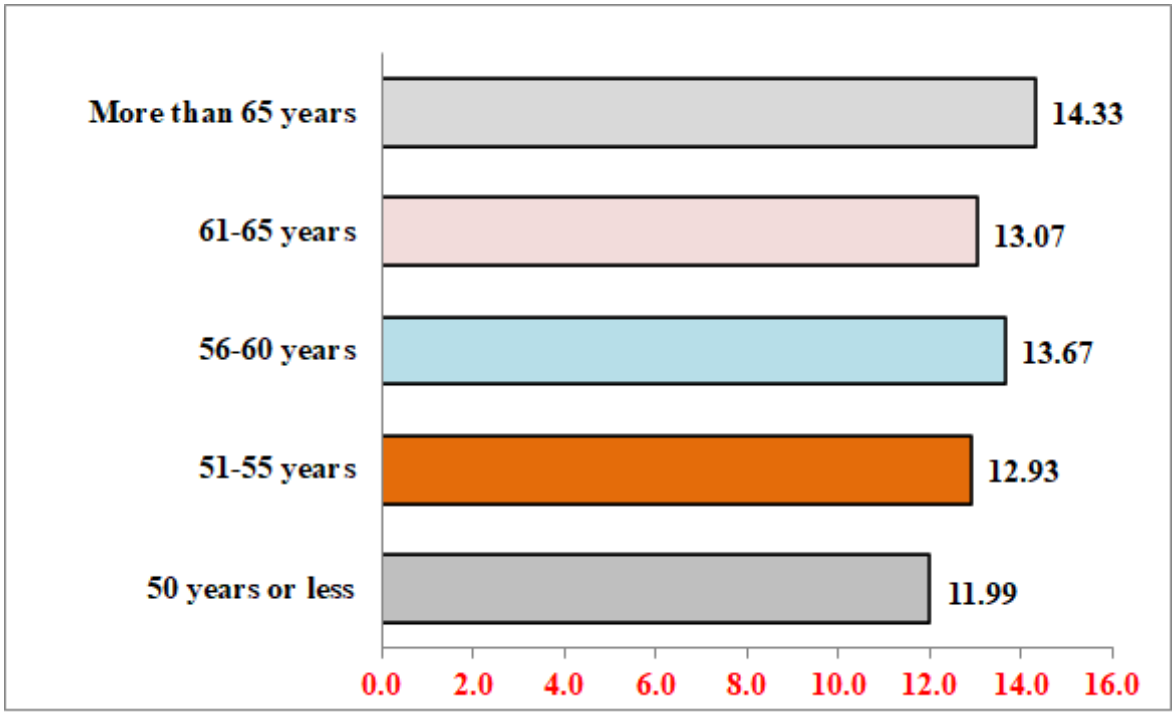

Figure (4.5): Distribution of DMFT according to age.

4.3.3.2 Variations of periodontal status related to socio-demographic data among study population.

Table (4.29): The mean differences in (periodontal status) Bleeding ,Pockets, loss of attachment related to socio-demographic data among study population (n = 376)

			(Max=32) M±SD	Statistical test Bleeding		(Max=32) M±SD	Statistical test Pocket		(Max=6) M±SD	Statistical test Loss of attachment	
	(n=376)	Sum		t/F	P-value		t/F	P-value		t/F	P-value
Age group											
≤ 50	84	146	4.2±5.74	0.755	0.555	3.95±5.76	0.986	0.562	1.74±2.09	1.332	0.258
51-55	69	142	5.62±7.18			3.06±4.99			2.06±2.07		
56-60	75	158	5.71±6.62			4.03±5.04			2.11±1.98		
61-65	70	157	4.71±6.15			4.89±5.87			2.24±2.02		
> 65	78	191	5.45±7.52			3.92±5.4			2.45±1.98		
Gender											
Male	169	426	6.22±7.44	2.933	0.004*	4.41±5.48	1.413	0.159	2.52±2.13	3.576	0.000**
Female	207	368	4.22±5.79			3.61±5.38			1.78±1.9		
Residency											
North Gaza	48	174	9.35±5.8	41.547	0.000**	0.06±0.43	20.894	0.000**	3.63±2.25	11.318	0.000**
Gaza city	199	343	3.28±4.94			4.08±4.95			1.72±1.75		
Middle zone	31	47	6.06±6.2			2.68±3.63			1.52±1.36		
Khan Younis	73	156	3.03±5.79			4.4±6.1			2.14±2.33		
Rafah	25	74	16.52±7.83			11±6.8			2.96±1.97		
Smoker											
Yes	45	110	6.67±7.78	2.993	0.050*	3.58±4.31	12.202	0.000**	2.44±2.06	4.448	0.012*
No	292	571	4.45±5.96			3.5±5.02			1.96±2		
Ex-smoker	39	113	8.36±8.78			7.92±7.68			2.9±2.12		

			(Max=32) M±SD	Statistical test Bleeding		(Max=32) M±SD	Statistical test Pocket		(Max=6) M±SD	Statistical test Loss of attachment	
	(n=376)	Sum		t/F	P-value		t/F	P-value		t/F	P-value
Level of education											
Illiterate	24	66	8.13±7.79	1.404	0.232	3.92±4.87	1.584	0.178	2.75±2.31	1.000	0.407
Up to elementary school	65	126	4.78±6.37			3.86±5.32			1.94±2.02		
Up to prepar school	104	224	4.66±6.09			2.95±4.85			2.15±2.09		
Up to secondary school	113	247	5.17±6.83			4.73±6.23			2.19±2.12		
University and above	70	131	4.99±6.91			4.37±5.05			1.87±1.69		
Marital status											
Unmarried	62	136	3.74±5.7	-1.787	0.075	4.02±5.82	0.072	0.943	2.19±2.12	0.346	0.729
Married	314	658	5.39±6.8			3.96±5.37			2.1±2.02		
Number of family member											
≤ 5	102	376	5.3±7.35	0.078	0.925	5.22±6.43	2.923	0.061	2.47±2.23	4.102	0.017*
6-10	219	254	5±6.55			3.41±4.86			1.87±1.84		
> 10	55	164	5.22±5.7			3.89±5.31			1.86±1.89		
Working status											
Employed	2	9	15±7.09	1.838	0.067	3.5±4.96	-1.025	0.306	2.13±2.05	0.404	0.686
Not employed	4	5	73±6.45			4.15±5.6			2.02±1.98		
Income											
Under deep poverty line (< 1974 NIS)	314	102	5.38±6.61	1.703	0.089	3.86±5.43	-0.890	0.374	274	2.69±2.26	3.386
Above deep poverty line (≥ 1974 NIS)	62	274	3.81±6.73			4.53±5.45			520	1.9±1.9	

M: mean, SD: standard deviation, *: P < 0.05, **: P < 0.001.

Regarding gingival bleeding, significant relationship is noticed between gender, smoking status and place of residence ($P < 0.05$). The mean presence of bleeding is higher in males compared to females (6.22. ±7.44 and 4.22±5.79, respectively). In addition, patients from Rafah show to have higher mean of gingival bleeding (16.52±7.83) followed by patients from north of Gaza (9.35±5.8), and ex-smokers patients show to have higher mean of gingival bleeding (8.36±8.78). Patients who are illiterate, between 56-60 years old and have family size less than 5 members and under poverty line have higher mean of gingival bleeding, but it is not-significant ($P > 0.05$).

With regard to presence of pocket, statistically significant is noticed with place of residency and smoking status ($P < 0.05$). patients living in Rafah have higher mean of pockets compared to other places (11±6.8), and ex-smokers as well (7.92±7.68). In another hand, males, patients at age 61-65 years, unemployed, whom continued up to secondary school education and who live under poverty line have higher mean of pockets, but it is not significant ($P>0.05$) (Table 4.29).

Additionally, significant differences are noticed between gender, number of family member, smoking status and place residence with regard to presence of loss of attachment ($P < 0.05$). The mean loss of attachment is high in males (2.52±2.13), patients live in north of Gaza (3.63±2.25), smokers (2.44±2.06) and family size below five members (2.47±2.23). In return, patients above 65 years old, whom are illiterate and live under poverty line have higher mean of loss of attachment compared to other categories, however, the mean is not statistically significant ($P > 0.05$) (Table 4.29).

In line with our findings, smoking is a significant factor for gingival bleeding, loss of attachment (Nwhator et al., 2005; Seitz et al., 2019). Additionally, elders above 60 years are also prone to periodontal diseases (gingival bleeding, loss of attachment) if they are diabetic (Ilea, 2019; Ueno, 201; Seitz et al., 2019). Moreover, males had worse periodontal status compared to their counterparts' females (Schulze et al., 2016). Additional risk factor was documented by Seitz et al. (2019) was overweight.

4.3.4 Variation of DMFT and periodontal status (Bleeding , pocket and loss of attachment)

related to clinical characteristics data among study population(n = 376)

Table (4.30) distribution of DMFT and periodontal status (Bleeding , pocket and loss of attachment) related to Duration of DM and HbA1c among study population(n = 376)

Domains	Duration DM (years)	N	Sum	M	SD	t	P-value
DMFT (Max=32)	10 or less	241	3148	13.06	6.39	0.491	0.623
	More than 10	135	1809	13.40	6.41		
Bleeding (Max=32)	10 or less	241	1153	4.78	6.53	1.298	0.195
	More than 10	135	771	5.71	6.85		
Poket-32 (Max=32)	10 or less	241	961	3.99	5.44	-0.080	0.936
	More than 10	135	532	3.94	5.44		
Loss of attachment (Max=6)	10 or less	241	496	2.06	2.03	0.682	0.496
	More than 10	135	298	2.21	2.04		
	HbA1c						
DMFT (Max=32)	≤ 7%	143	1863	13.03	6.30	0.369	0.712
	> 7%	233	3094	13.28	6.46		
Bleeding (Max=32)	≤ 7%	143	596	4.17	5.92	2.179	**0.030***
	> 7%	233	1328	5.70	7.01		
Pocket (Max=32)	≤ 7%	143	579	4.05	5.63	-0.218	0.827
	> 7%	233	914	3.92	5.32		
Loss of attachment (Max=6)	≤ 7%	143	263	1.84	1.92	2.043	**0.042***
	> 7%	233	531	2.28	2.09		

M: mean, SD: standard deviation, *: P < 0.05, **: P < 0.001

The mean of DMFT, gingival bleeding, and loss of attachment is higher among patients having T2DM for more than 10 years, whereas, the mean of pocket is higher among patients having T2DM less than 10 years. Indeed, mean differences are not statistically significant (P < 0.05). Similar findings are noticed with regard to HbA1c (> 7%), however, statistically significant is seen with gingival bleeding and loss of attachment (P < 0.05) (Table 4.30).

The results of this study confirmed the link, but not causal, between periodontitis and glycemic control of diabetes similar to results of Preshaw et al. (2019) and Lakschevitz et al. (2011). It is also in line with the Japanese study of Yonekura and his colleagues (2017) and African study of Guinan (2018) and the study of Almousawi (2018). The African study was conducted in the west of Africa among 356 diabetes, and the DMF index, periodontal diseases, as measured by the CPITN, increased in un-controlled DM. In another hand,

duration of DM is associated with bad periodontal status and DMFT index, which is consistent with findings of Alqedra and aljeesh (2020) study. Morita and her colleagues (2012) found clear link between developing periodontal diseases and pockets more than 4mm with increased level of HbA1c. However, Coelho et al. (2020) could not find differences between groups regarding dental caries.

Table (4.31) distribution of DMFT related to other chronic disease among study population (n = 376)

Chronic disease		N	Sum	M	SD	t/F	P-value
Chronic disease	**No**	140	1813	12.95	6.63	0.612	0.541
	Yes	236	3144	13.34	6.24		
If yes, Chronic disease							0.116
	Arthritis	4	67	16.75	2.75		
	Arthritis, Hypertension	1	7	7.00	-		
	Asthma	4	45	11.25	9.54		
	Heart disease	16	236	14.75	6.62		
	Hypertension	165	2191.2	13.28	6.08		
	Hypertension, Asthma	2	53	26.50	7.78		
	Hypertension, cancer	1	19	19.00	-		
	Hypertension, Heart disease	41	494.05	12.05	6.09		
	Hypertension, Kidney disease	1	19	19.00	-		
	Osteoporosis	1	13	13.00	-		

The mean of DMFT is higher among patients who reported to have chronic diseases compared to no chronic diseases (13.3±6.2 vs 12.9±6.6), however it is not significant. It is noticed that the mean is higher among patients with history of hypertension and asthma (26.5), followed by hypertension with kidney diseases and hypertension with cancer (19) (Table 4.31). similar findings were obtained from a retrospective study conducted by Kim et al. (2021). Studies on the bidirectional link between non-communicble diseases and oral health received interest of researchers because both diseases are multifactorial and are characterized by chronic inflammatory responses (Dorfer et al., 2017' KEdar et al., 2018). A possible explanation for this link, is that long term duration intake of medications of systematic diseases result in decreased saliva flow and dry mouth, resulting in overgrowth of oral microbial. Oral microbial is a detriment to oral health and is an significant factor in the initiation of dental caries and periodontitis (Rosier, Marsh, Mira, 2018).

Table (4.32) distribution of periodontal status (gingival bleeding, pocket and loss of attachment) related to other chronic disease among study population(n = 376)

	Chronic disease	N	Sum	M	SD	t/F	P-value
Bleeding	**No**	236	1283	5.44	1.21	0.227	0.858
	Yes	140	641	4.58			
Pocket	**No**	236	1014	4.30	1.51	0.131	0.875
	Yes	140	479	3.42			
Loss of attachments	**No**	236	445	1.89	0.35	0.725	0.028
	Yes	140	260	1.86			
If yes, Chronic disease							
Bleeding							0.064
	Arthritis	4	21	5.25	7.37		
	Arthritis, Hypertension	1	0	0.00	-		
	Asthma	4	32	8.00	12.33		
	Heart disease	16	79	4.94	6.23		
	Hypertension	165	934	5.66	7.05		
	Hypertension, Asthma	2	42	21.00	9.90		
	Hypertension, cancer	1	10	10.00	-		
	Hypertension, Heart disease	41	153	3.73	4.85		
	Hypertension, Kidney disease	1	6	6.00	-		
	Osteoporosis	1	8	8.00	-		
Pocket							0.144
	Arthritis	4	6	1.50	3.00		
	Arthritis, Hypertension	1	0	0.00	-		
	Asthma	4	11	2.75	5.50		
	Heart disease	16	56	3.50	5.13		
	Hypertension	165	756	4.58	5.68		
	Hypertension, Asthma	2	30	15.00	21.21		
	Hypertension, cancer	1	0	0.00	-		
	Hypertension, Heart disease	41	152	3.71	4.54		
	Hypertension, Kidney disease	1	3	3.00	-		
	Osteoporosis	1	0	0.00	-		
Loss of attachments							0.741
	Arthritis	4	9	2.25	0.50		
	Arthritis, Hypertension	1	3	3.00	-		
	Asthma	4	7	1.75	0.96		
	Heart disease	16	33	2.06	0.77		
	Hypertension	165	312	1.89	0.75		
	Hypertension, Asthma	2	4	2.00	0.00		
	Hypertension, cancer	1	2	2.00	-		
	Hypertension, Heart disease	41	72	1.76	0.77		
	Hypertension, Kidney disease	1	1	1.00	-		
	Osteoporosis	1	2	2.00	-		

The mean of gingival bleeding, periodontal pocket and loss of attachment is seen to be high among patients with no history of chronic diseases, however, it is not statistically significant. Patients who reported to have hypertension and asthma together are more susceptible to gingival bleeding and periodontal pocket .In return, loss of attachment is quite similar among patients with various diseases (Table 4.32).

4.4 Patients' oral health experience

In addition to what have been extracted from the qualitative study and are embedded into results sub-sections, other problems experienced by interviewed patients are presented. Patients who have dental and gum problems complain from eating difficulties because they can't chew foods. Moreover, they have been deprived from taking all types of foods they used to eat before symptoms of oral complications appear. Some of them feel their nutrition system needs to be improved and modified by decrease eating sugar and carbohydrates products because they worse dental and body status. Two of them does not see any effect of DM on their nutrition status.

"…when you avoid eating sugar ,your teeth and health will be good…" (Female,Gaza,51 years)

"…diabetic disease didn't affect my nutrition and my teeth…" (Female,Khanunis,54 years)

"…I face difficulty with chewing food …" (Male, Khanunis,58 years;Female,Gaza,50 years)

"…I feel sad when I look to my teeth ,all are fallen and then I can't eat…" (Female,Khanunis,72 years)

"…my nutrition system is change ,I stopped eating sugary and chocolate…" (Female,Gaza,60 years)

In this qualitative study, the researcher aimed to explore patients' experiences and their needs to oral care. The key synthesized themes are around quality of dental care, patient dentist relationship, patients' experiences and self-oral care and hygiene. Patients perspectives varied with regard to dental visits patterns; few were satisfied with information given by dentists, while most of them did express in negative manner, and visiting dentists is not priority unless teeth are affected. This is in line with findings of Sanz et al. (2018) and

Bisset et al. (2013) who reflected the need to educate diabetes personnel with importance of dental and oral care to preserve general health status (Bissett et al., 2013).

The participants are aware of the effect of T2DM on the teeth and mouth cavity. However, this knowledge is not deeply explained. They are unaware about the bidirectional effect of DM on periodontitis and vice versa. The effect is limited to teeth pain, teeth loss and gum problems including bad mouth odor. This is similar to findings of Fadel and his colleagues (2021) in which participants expressed difficulties could diabetic patients face including oral discomfort, pain and social interaction resulted from bad appearance. This finding point out to role of dentists and general practitioner to address each patient complains and manage them accordingly. The researcher recommends to inform diabetic patients that their general health could be worsen given that periodontal status is also worsen, and thus measures to prevent and control oral diseases may improve glycemic control and vice versa. Indeed, dentists and general practitioners were not interviewed, and the researcher do recommend further exploration of their knowledge about the bidirectional relationship between periodontitis and DM.

The participant did describe the manner of dental and oral care. Most of them used toothbrush and toothpaste but not regularly, while few used other methods like mouth wash and gargle. Mouthwash was commonly practices if dental and gingival pain occurs. This had also been reported among Saudi diabetes patients (Fadel et al., 2021). Indeed, the study of Slack-Smith and his colleagues (2010) found interviewed patients used electric toothbrush, mouthwash and floss regularly and they had regular dental visit in the past two years. Our patients do not regularly visit dentists or were not referred from general practitioners at the PHCs. It seems that adherence oral hygiene practices is linked to dental visits. The researcher suggests to foster oral hygiene practices through appropriate health education and information. Oral hygiene includes, but not limited to, routine dental checkup, routine oral care using various approaches like floss, mouthwash and toothbrush. By and large, to improve patient's adherence to ideal oral care practices, a health promotion activity should be well addressed.

Interviewees revealed that dentists do not discuss with diabetic patients how effective diabetes management will positively influence the oral health. As a source of speculation, dentists view this as outside their responsibilities and it is expecting to discuss diabetes

management with general practitioners rather than dentists who feel themselves unable to discuss diabetes management and glycemic control with patients because of inadequate knowledge. Dentists might provide incorrect information which contradict the medical professionals. In USA, dentists were unwilling to actively involved in patients' diabetes management because they feel they have inadequate knowledge and training (Kunzel, Lalla & Lamster, 2007). Similar findings were also reported from New Zealand (Forbes et al., 2008).

Patients do visit dentist at PHCs only for tooth extraction because they know that essential dental services are not available, however, dentists have a great role when patients visit them to discuss risk factors that are shared with oral diseases and are linked to uncontrolled DM. These risk factors, like smoking, lack of physical activity and diet, may worsen periodontal status and compromise success of treatment (Harris, 2012).

Generally, participants thought that dental care services are comprehensive and affordable in public clinics, however, are later surprised and choked of unavailability of many dental services including the essential ones. However, it has been reported by the MoH (2021) that dental clinics at the governmental PHCs received 120,994 visits, in which teeth restoration, extraction, treatment of root canal, and management of gingivae represent 22%, 13.8%, 6.8% and 55.1% of the whole visits. The high treatment costs were the main concern regarding the private sector given that they provide high quality of services. This issue have been highlighted and presented by Mittal et al. (2019) and Fadel et al. (2021). There is a need to restructure dental services in the governmental clinics to make them available, affordable to low cost and acceptable to diabetic patients in need for the services.

Many patients have reported no link between general practitioner and dentists. As a matter of fact, this division is not new because the two professions are emerged separately and independently regulated professions. This division might have negative impact on interventions aimed to promote inter-professional cooperation. As oral health influence the general health of individuals including diabetic patients, the research do recommend oral care integration in the practice of family medicine.

Patients reported inability to afford the cost of dental services in private clinics. Indeed, most costs are toward complications of DM which are mostly preventable. In the UK, 80% of direct costs are directed to treat oral complications (Bissett et al., 2013). The direct and indirect cost of treating DM is expected to raise from £9.8billion to £16.8billion by 2035. Regular oral health hygiene and early screening are seemed to be cost effective through inter-professional collaboration.

Many dental and oral problem have been mentioned by participants commonly are dental loss, caries, and mobility in addition to mouth ulcer and bad odor. Indeed, this is natural end result of diabetes mellitus disease given that glycemic level is not controlled for long time. As per our patients, all participants who reported oral problems have un-control T2DM explained by HbA1c above 10%. A very recent systematic and meta-analysis study performed by Ahmadinia et al. (2022) revealed strong association between T2DM and tooth loss. Additionally, Hasting and Vasques (2017) confirmed the link between diabetes mellitus and inflammatory gum diseases. Serious gum infection leads to damage of the soft tissue and if left untreated damage may extend to bone which support the teeth. The researcher think that these complications could not be happened if patients have regular dental checkup visits and follow best diabetes self-management activities to control glycemic status.

These complications are seen to influence patients' quality of life. Weiner et al. (2017) revealed negative impact of oral complications among diabetes mellitus patients on quality of life and specifically on nutrition status, socialization, economic and psychological aspect of life (Hasting & Vasques, 2017). With regard to problems of nutrition, oral health is determined as an important and significant determinant for malnutrition. Patients living with diabetes and face oral complications have shown to have changes in lifestyle pattern. For instance, they do not eat hard food as they used to which may result in deficiency of essential micronutrients for preserving teeth such as vitamin C and magnesium. Furthermore, lack of other essential micronutrients require for good function of human body result in decrease organ function and productivity. Finally, the overall quality of life is affected.

Chapter Five

Conclusion and Recommendations

5.1 Conclusion

T2DM is a chronic progressive disease that is seen to affect human body including oral cavity. Oral complications raised from T2DM are well documented in literature and if remained untreated will lead to unpleasant consequences affecting the quality of life in general. In detailed, it influences the socio-economic, psychological and physiological aspect of life. Therefore, oral complications are preventable at first, and following simple oral hygiene would result in delay occurrence of these complications.

In this cross-sectional study, the researcher sought to investigate the oral health status, needs, and barriers faced by type 2 diabetic patients visiting government PHCs in Gaza Governorates when seeking oral health care, as well as the most frequent barriers they encountered. The study also identified a link between DM and dental health problems. Majority of the participants were living in an impoverished and congested city, were unemployed, and lacked stable means of income in line with current conditions in the Gaza Strip due to the siege.

Participants were chosen from 4 large and 1 small MOH health centers across all 5 geographic zones. In this study, 376 DM type 2 patients over the age of 40 took part. Two thirds of participants had uncontrolled diabetes, and the researcher stated that the number of DM patients had nearly doubled over the past ten years. It is obvious that little is known about the serious complications of DM. Unavailability of necessary dental supplies deprived patients to be seen by dentists at PHCs and direct to private clinics.

Majority of individuals reported having mediocre or bad teeth and gums, with the majority exhibiting a significant number of missing teeth. The participant's regularity in brushing their teeth attests to their lack of awareness regarding oral health maintenance, ignorance of oral DM problems, and lack of access to proper health education. Dental visits are still not seen as a preventive dental habit, as evidenced by the lack of knowledge of the advantages of routine dental examinations. It just relies on treatment needs at the moment. Another factor can be diabetes patients' ignorance about the oral effects of the disease and their perception of a lack of time for this extra healthcare task while they are preoccupied with managing their condition.

Most participants declared that dental problems did not impact on their life activities. Large portion of patients involved in the quantitative study have positive attitudes in terms of susceptibility to and severity of complications raised from T2DM. Moreover, they admired the benefits of oral hygiene practices. However, they perceived many barriers resulted in low commitment to oral hygiene. The common notable complications are dental caries, teeth loss and periodontitis. A high DMFT index and around half of participants had no periodontitis, according to the results. The study found that diabetics have a high rate of tooth loss, so many patients still need dental replacement services for their missing teeth. However, participants lacked the willingness to replace their missing teeth with partial dentures due to financial concerns or because they were unaware of the consequences of doing so.

The DMFT index value was substantially correlated with individuals' smoking status, place of residence, and gender but not with their age or monthly income. Because adult women use dental care to a greater extent than men and because men are more willing to pull teeth than women, the researcher thinks that men have higher DMFT indices than women. There is a statistically significant correlation found between participants' smoking status, residency location, and periodontal pockets. Additionally, there is a statistically significant relationship between gingival bleeding and loss of attachment and these variables include gender, smoking status, and residence.

Patients with T2DM for more over 10 years have higher rates of DMFT, gingival hemorrhage, and loss of attachment, whereas patients with T2DM for less than 10 years have higher rates of mean of pocket. There aren't statistically significant, in fact. Similar results are observed for HbA1c (> 7%), however gingival hemorrhage and loss of attachment show statistical significance. DMFT is higher in individuals who reported having chronic conditions than in patients who did not, although the difference is not statistically significant. Additionally, there is no statistically significant correlation between chronic disease reporting and periodontal health. The most frequent problems encountered by DM patients seeking oral health care at MOH PHC dental stations were the lack of complete oral health services and advanced treatment, as well as far appointments.

Patients are not satisfied with quality of dental services provided at governmental PHCs. This is translated in lack of dental and medical supplies, lack of essential dental services, lack of appointment and follow up system and non-integration of oral health in the family medicine. Furthermore, the high cost of dental services in private clinics is another concern

which pose burden to family's life. Other patients concern are about lack of information and education delivered from dentists and nutrition problems associated with presence of dental problems like mouth ulcer, teeth loss and dental pain. All these points have been categorized into four main themes produced from the qualitative study: Quality of dental care services, Patient dentist relationship, Self-oral care and hygiene and Patient's oral health experiences.

5.2 Recommendations

According to the study findings, the researcher recommends the following points to improve oral health of T2DM patients.

5.2.1 Recommendation for MOH

1-Involvement of oral and dental health education program providing to diabetic patients at PHCs and including:

- Effect of DM on oral health
- Best and traditional practices of oral hygiene.
- Describing high risk group of oral complications.
- Describing most common oral and dental diseases related to DM.
- Importance of follow up and adherence to health instructions.
- Describing severity of oral and dental diseases related to DM.
- Describing importance of keeping glycemic level controlled.
- Describing risk for systemic diseases resulting from treated oral and dental diseases raised from DM.

2-Make dental care available at PHCs and protect poor and most in need patients through :

- Consider dental care as an essential service similar to chronic diseases services and vaccination.
- Waving patients who are not affording cost of dental services from fees.
- Making essential supply available at PHCs including disposables.

3-integrating oral and dental health care within family medicine through:

- Establishment follow up and appointment system to follow oral health status of diabetic patients.
- Referral of high risk groups to oral and dental check up.

- Routine and periodic screening for most common reported diseases (periodontitis, dental caries, tooth loss,…)
- Prioritization of oral and dental screening based on high risk group.

4-Capacity building of dentists around DM:

pathophysiology, symptoms, complications, diabetes management through;

- Regular training, health educations and symposiums.
- Involvement of Palestine Dental Association in developing dental capacity.

5- Enhancing inter-professional communication and collaboration between general practitioners and dentists at primary health care level

6-Enhancing role of diabetic educators/nurses in PHCs and consider formal health education program.

7-Utilization of technology to deliver healthy messages related to DM and oral health. These new tools include what's up, SMS, social media.

5.2.2 Recommendation for further research

1-Further qualitative study to explore reasons for low knowledge level around oral health of diabetic patients.

2-Further qualitative study with dentists and general practioners at PHCs to determine unmet needs of diabetic patients regarding to oral and dental health.

3-Further exploratory study with senior management at the general director of primary health care to determine MOH strategies to overcome challenges facing oral and dental health care.

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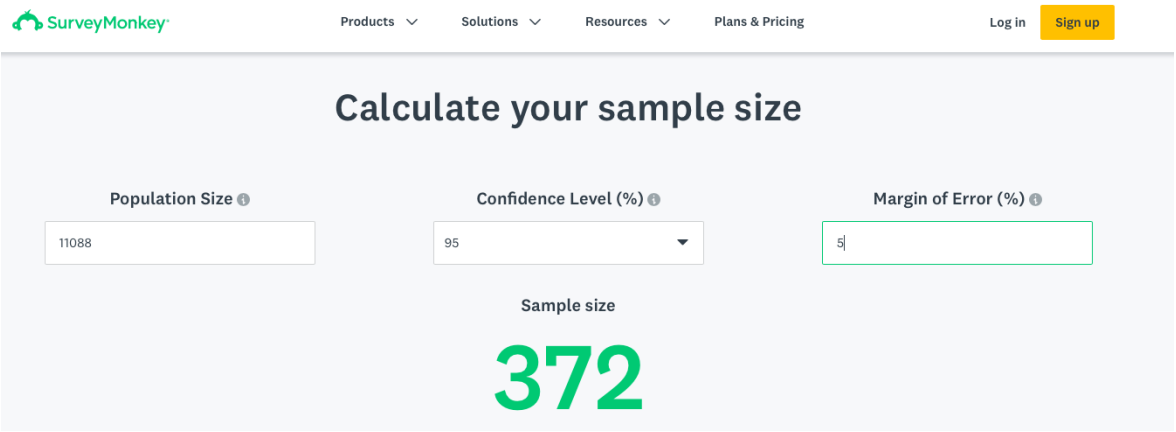
Annexes

Annex (1): Study activities timetable

Activity	Jan 21	Feb 21	Mar 21	Apr 21	May 21	Sept 21	Oct 21	Nov 21	Dec 22	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22
Preliminary reading and consolidating the idea															
Literature review and writing problem statement															
Finalizing and submitting proposal															
Proposal discussion and approval															
Developing quantitative and qualitative tools															
Seeking ethical approval															
Conducting pilot testing															
Actual data collection															
Data entry															
Data analysis															
Report writing and submission to defense															
Defense and discussion of the thesis															
Final submission of the thesis															

Annex (2) : Sample size calculation



Annex (3): Cover letter of research English

Oral Health Status Among Type II Diabetes Mellitus Patients Attending Governmental Primary Health Centers at Gaza Governorate

Dear participant:

I am Aesha Fetaiha, a student at the master's degree of Health policy and management track quality and patient safety in public health college at Al-Quds University.. I conduct a research study about oral health status among type II diabetes mellitus patients attending governmental primary health centers at Gaza governorate to fulfill requirement for the master's degree .You have been randomly selected and I ensure your voluntary participation where you are able to not answer any question or withdraw from the study whenever you feel that. Your participation has no direct or indirect negative implications on you.

If you agree to participate, you are requested sit for oral health examination followed by interview based questionnaire. The whole time will not exceed 20 minutes and the researcher ensure anonymity of participants and confidentiality of data which will only use for research purpose only. The study is self-funded and is completely independent and has no connection to any government, authority or official body.

Findings of this study may help for better understanding of oral health problems among type 2 diabetic patients, determining their awareness to oral health complications associated with diabetic disease and to illustrate T2DM patients' perception toward oral complications and oral hygiene. The study is looking ultimately to provide health care providers and policy makers with recommendations that might help in prevention or decreasing the occurrence complication of oral diseases. The questionnaire gives you the opportunity to tell us about status of your oral health.

The Researcher **give consent**
Aesha Fetaiha ----------

Oral Health Status Among Type II Diabetes Mellitus Patients Attending Governmental Primary Health Centers at Gaza Governorate

Sociodemographic characteristics						
1	**Serial number:** ( )		**Age**: ( ) years			
2	**Gender:**		( ) male		( ) female	
3	**Place**	( ) North Gaza	( ) Gaza city	( ) Mid zone	( ) Khanyuouns	( ) Rafah
4	**Are you smoker:**		( ) Yes How many cigarettes? ( ) How many hookah? ( )	( ) No	( ) Ex-smoker	
5	**Educational level:**		○ Illiterate ☐ ○ Up to primary school ☐ ○ Up to preparatory school ☐ ○ Up to secondary education ☐ ○ University or above ☐			
6	**Marital status:**	( )single	( ) married	( ) other		
7	**Income :**	……..				
8	**Number of family members :** ……					
9	**Working status:**	( ) employed	( ) not employed	( ) Retired	( ) free lancer	( ) Housewife
10	**Do you have a medical insurance?**		( ) Yes	( ) No		
Clinical characteristics						
11	**Diabetic age (How many years with T2DM?):** ……. Years					
12	**Family history of oral complications from T2DM?**		**( )** Yes	**( )** No		
12	**Type of treatment:**		○ Diet restriction and physical activity ☐ ○ Insulin injections ☐ ○ Oral hypoglycemic agents ☐ ○ Oral hypoglycemic and insulin injections ☐			

13	**Have you received health education regarding oral health practices**?	( ) Yes	( ) No
14	**The last value of HbA1C**? …….		
15	**The last value of fasting blood glucose level**? ……		
16	**Do you have other chronic diseases?**	( ) Yes **Please specify:** ……	( ) No
17	**Have you suffered from oral and dental diseases during the last year?**	( ) Yes <u>Specify ;</u> ( )Tooth mobility ( )Tooth loss ( )Tooth decay ( )Tooth sensitivity ( )Gum bleeding ( )Bad Odor ( )Bacterial infection ( )Fungal infection	( ) No
18	**During the last year, have you visited a dental clinic?**	( ) Yes	( ) No
19	**What was the reason for your last visit to the dentist?**	○ Consultation/advise ☐ ○ Pain or trouble with teeth, gums or mouth ☐ ○ Treatment/ follow-up treatment ☐ ○ periodic check-up ☐ ○ Don't know/don't remember ☐	

Perceived susceptibility to oral complications		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
20	I am not at risk for developing dental caries.*					
21	Because I am diabetic patient, I am riskier to develop oral diseases than others.					
22	My teeth are healthy because i don't suffer from dental pain					
23	Although I have DM, my good health status protects me from getting oral complications.					
24	I am at higher risk of getting oral complications because of family history of oral complications resulted from DM.					

Perceived severity of oral complications		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
25	Oral diseases are not easy to manage*					
26	The thought of getting oral complications scares me.					
27	If I got oral complications, my physical status would badly change.					
28	Getting oral complications will affect my social relationship (cannot laugh, interact and speak with others,..)					
29	Getting oral complications will bring heavy economic burden to me and my family.					
30	Developing oral complications would be more serious than other diseases					
Perceived benefits from oral health practices		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
31	Oral hygiene is necessary even if I have no oral symptoms.					
32	Oral hygiene practices do not help in prevention of oral complications.*					
33	Early detection of oral complications provides good chance for therapy.					
34	Routine dental checkup decreases opportunities of oral complications occurrence.					
Perceived barriers to oral health practices		**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
35	I fear sitting on dental chair					
36	Dental brush bleeds my gum					
37	I have no adequate information about oral hygiene practices*					
38	I cannot afford the cost of dental checkup*					

	Awareness on oral health complications related to T2DM	Yes	No	Don't know
39	Diabetic patients require to care more often than non-diabetics for their teeth and mouth			
40	Regular dental visit is more important for diabetic patients than non-diabetics.			
41	Diabetics have gum problems more often if their blood sugar is uncontrolled			
42	Oral problems associated with diabetes:			
	• Mouth dryness			
	• Gums bleeding on brushing			
	• Mouth ulcers			
	• Bad odor			
	• Dental caries			
	• Oral bacterial infections.			
	• Fungal mouth infections			
	• Loose teeth			
	• Taste problems			
	• Burning sensation			
43	Smoker diabetics have less serious gum disease than non-smokers.*			
44	T2DM causes delayed wound healing at dental extraction sites			
45	T2DM contributes more to developed dental abscess			
46	As a diabetic, poor oral health condition affects badly the general health status			

	Oral health practices	Never	Rarely	Sometimes	Often	Always
47	I brush my teeth twice a day					
48	I brush my teeth for at least two minutes each time					
49	I use toothbrush and paste to clean my teeth					
50	I follow the vertical technique of brushing the teeth					

51	I used to change toothbrush four times a year					
52	I use mouthwash to preserve and keep my gum healthy					
53	I remove interdental debris using dental floss or toothpick once a day					
54	I clean my tongue					
55	I use other methods than toothpaste and toothbrush to clean my mouth:					
	Silica Powder					
	Miswak					
	Finger and paste					
	Rinse with salty water					
	Rinse with herbs					
	Rinse with water only					
56	I used to visit a dentist, for checkup, twice a year					

Annex (4): Cover letter of research Arabic

حالة صحة الفم لدى مرضى السكري من النوع الثاني الذين يترددون على مراكز الرعاية الأولية الحكومية في محافظات غزة

عزيزي المشارك/ة:

أنا عائشة فتيحة، طالبة في برنامج ماجستير السياسات والإدارة الصحية مسار الجودة وسلامه المريض في كليه الصحة العامة بجامعة القدس وأجري دراسة بحثية حول حالة صحة الفم بين مرضى السكري من النوع الثاني الذين يحضرون إلى المراكز الصحية الأولية الحكومية في محافظات غزة وذلك كمتطلب استيفاء لدرجة الماجستير. وقد تم اختياركم بشكل عشوائي في هذه الدراسة مع العلم ان مشاركتك لن يكون لها آثار سلبية مباشرة أو غير مباشرة عليك.

تتطلب المشاركة في هذه الدراسة أولا تقييم سريري لحالة الفم ثم ملء استبيان قائم على المقابلة. يؤكد الباحث على طوعية المشاركة وحق المشارك بعدم الإجابة على أي سؤال أو الانسحاب من الدراسة اذا شعر انه بحاجة لذلك. كذلك يؤكد على سرية البيانات وشخصيتكم وعدم استخدامها إلا لأغراض البحث العلمي فقط مع العلم أن الدراسة ممولة ذاتيا وهي مستقلة تمامًا وليس لها صلة بأي حكومة أو سلطة أو هيئة رسمية..

ستساعد نتائج واستنتاجات هذه الدراسة في فهم أفضل لمشاكل صحة الفم بين مرضى السكري من النوع 2، وتحديد وعيهم بمضاعفات صحة الفم المرتبطة بمرض السكري، حيث يمنحك الاستبيان الفرصة لإخبارنا عن حالة صحة فمك. تتطلع الدراسة في نهاية المطاف إلى تزويد مقدمي الرعاية الصحية وصانعي القرار بالتوصيات التي تساعد على الوقاية أو تقليل حدوث مضاعفات لأمراض الفم. سيستغرق الاستبيان والتقييم حوالي 20 دقيقة من وقتك الثمين

الباحثة: عائشة فتيحة إقرار بالموافقة

استبيان

حالة صحة الفم لدى مرضى السكري من النوع الثاني الذين يترددون على مراكز الصحة الأولية الحكومية في محافظة غزة

الخصائص الاجتماعية الديموغرافية						
1	**الرقم التسلسلي:** ( )	**العمر:** ( )				
2	**الجنس:**	( ) ذكر	( ) أنثى			
3	**المكان:**	( )شمال غزة	( ) مدينة غزة	( ) المنطقة الوسطى	( )خانيونس	( )رفح
4	**هل انت مدخن :**	( ) نعم كم عدد السجائر باليوم ( )؟ كم مره شيشه باليوم ( ) ؟	( ) لا	( ) مدخن سابق		
5	**المستوى التعليمي :**	○ أمي ☐ ○ حتى المدرسة الابتدائية ☐ ○ حتى المدرسة الإعدادية ☐ ○ حتى التعليم الثانوي ☐ ○ جامعة أو أعلى ☐				
6	**الحالة الاجتماعية:**	( ) أعزب	( ) متزوج	( ) أخرى		
7	**الدخل:**					
8	**عدد أفراد الأسرة :**					
9	**حالة العمل:**	( ) موظف	( ) غير موظف	( ) متقاعد	( )عمل حر	( ) ربة منزل
10	**هل لديك تأمين طبي؟**	( ) نعم	( ) لا			
الخصائص السريرية						
11	**كم سنة تعاني من مرض السكر؟** ..... سنوات					
12	**هل يوجد تاريخ عائلي لمضاعفات الفم من مرض السكر؟**	**( ) نعم**	**( )لا**			
12	**نوع العلاج:**	○ تقييد النظام الغذائي والنشاط البدني ☐ ○ حقن الأنسولين ☐ ○ حبوب عن طريق الفم ☐ ○ حقن الأنسولين وحبوب عن طريق الفم ☐				
13	**هل تلقيت تثقيفًا صحيًا بشأن ممارسات صحة الفم؟**	( ) نعم	( ) لا			
14	**القيمة الأخيرة لمخزون السكر ؟**					
15	**أخر قراءه لمستوى السكر بالدم (صائم)؟**					
16	**هل تعانين من أمراض مزمنة أخرى؟**	( ) نعم **رجاء حدد:**	( )لا			

17	**هل عانيت من أمراض الفم والأسنان خلال العام الماضي؟**	( ) نعم حدد: ( ) حركة الأسنان ( ) فقدان الأسنان ( ) تسوس الأسنان ( ) حساسية الأسنان ( ) نزيف والتهاب اللثة ( ) رائحة فم كريهة ( ) التهابات بكتيرية ( ) التهابات فطرية ( )تقرحات فم	( ) لا
18	**خلال العام الماضي، هل زرت عيادة أسنان؟**	( ) نعم	( ) لا
19	**ما سبب زيارتك الأخيرة لطبيب الأسنان؟**	○ استشارة / نصيحة ☐ ○ ألم أو مشكلة في الأسنان أو اللثة أو الفم ☐ ○ العلاج / متابعة العلاج ☐ ○ الفحص الدوري ☐ ○ لا أعرف / لا أتذكر ☐	

	القابلية المتصورة لمضاعفات الفم	**أرفض بشدة**	**أرفض**	**حيادي**	**أوافق**	**أوافق بشدة**
20	أنا لست معرض لخطر الإصابة بتسوس الأسنان.*					
21	لأنني مريض بداء السكري، فأنا أكثر قابليه للإصابة بأمراض الفم من الآخرين.					
22	أنا لا أعاني من آلام الأسنان، لذا فإن أسناني صحية.					
23	على الرغم من إصابتي بمرض السكري، إلا أن حالتي الصحية الجيدة تحميني من الإصابة بمضاعفات الفم.					
24	أنا أكثر عرضة للإصابة بمضاعفات الفم بسبب التاريخ العائلي للمضاعفات الفموية الناتجة عن مرض السكري					
	الشدة المتصورة لمضاعفات الفم	**أرفض بشدة**	**أرفض**	**حيادي**	**أوافق**	**أوافق بشدة**
25	ليس من السهل علاج أمراض الفم عند الإصابة بها.*					
26	التفكير في حدوث مضاعفات في الفم يخيفني.					
27	إذا أصبت بمضاعفات في الفم، فإن حالتي الجسدية ستتأثر بشكل سيء.					
28	سيؤثر الحصول على المضاعفات الفموية على علاقتي الاجتماعية (لا يمكنني الضحك والتفاعل والتحدث مع الاخرين...)					
29	إن الإصابة بمضاعفات في الفم ستضع عبئًا اقتصاديًا ثقيلًا عليّ وعلى عائلتي.					
30	قد يكون تطور المضاعفات الفموية أكثر شده من الأمراض الأخرى.					

	الفوائد المتصورة من ممارسات صحة الفم	أرفض بشدة	أرفض	حيادي	أوافق	أوافق بشدة
31	نظافة الفم ضرورية حتى لو لم أعاني من أعراض فموية.					
32	لا تساعد ممارسات نظافة الفم في الوقاية من مضاعفات الفم. *					
33	يوفر الاكتشاف المبكر لمضاعفات الفم فرصة جيدة للعلاج.					
34	يقلل الفحص الدوري للأسنان من فرص حدوث مضاعفات الفم.					
	الحواجز الملحوظة التي تعترض ممارسات صحة الفم	**أرفض بشدة**	**أرفض**	**حيادي**	**أوافق**	**أوافق بشدة**
35	أخشى الجلوس على كرسي الأسنان.					
36	استخدام فرشاة الأسنان ينزف لثتي.					
37	ليس لدي معلومات كافيه حول ممارسات نظافة الفم. *					
38	لا أستطيع تحمل تكلفة فحص الأسنان. *					

	التوعية بمضاعفات صحة الفم المتعلقة بمرض السكر النوع الثاني	نعم	لا	لا أعرف
39	بصفتي مصابًا بداء السكري، يجب أن أقوم بممارسة العناية الذاتية بالفم أكثر من الأشخاص العاديين للوقاية من أمراض الفم.			
40	الفحص الدوري للأسنان أكثر أهمية لمرضى السكري من غير المصابين بالسكري.			
41	يعاني مرضى السكر في كثير من الأحيان من مشاكل في اللثة إذا كانت نسبة السكر في الدم لديهم غير مضبوطة			
42	:مشاكل الفم المصاحبة لمرض السكري			
	• جفاف الفم			
	• نزيف اللثة عند تنظيف الأسنان بالفرشاة			
	• تقرحات بالفم			
	• رائحة فم كريهة			
	• تسوس الأسنان			
	• التهابات الفم البكتيرية			
	• التهابات الفم الفطرية			
	• سقوط الأسنان			
	• مشاكل التذوق			
	• الشعور بالحرقة بالفم			
43	يعاني مرضى السكر من المدخنين من أمراض اللثة اقل من غير المدخنين. *			
44	في تأخير التئام الجروح في مواقع خلع الأسنان. مرض السكر يتسبب			
45	بشكل أكبر في تكوين خراج الأسنان. مرض السكر يساهم			
46	كمصاب بالسكري، تؤثر حالة صحة الفم السيئة بشكل سيء على الحالة الصحية العامة.			

	ممارسات صحة الفم	مطلقا	نادرا	بعض الأحيان	غالبا	دائما
47	أنظف أسناني مرتين في اليوم.					
48	أقوم بتنظيف أسناني لمدة دقيقتين على الأقل في كل مرة.					
49	أستخدم فرشاة أسنان والمعجون لتنظيف أسناني.					
50	أتبع الطريقة العمودية لتنظيف الأسنان بالفرشاة.					
51	اعتدت على تغيير فرشاة الأسنان أربع مرات في السنة.					
52	أستخدم غسول الفم للحفاظ على صحة اللثة.					
53	أقوم بإزالة بقايا الطعام بين الأسنان باستخدام خيط تنظيف الأسنان او نكاشه الأسنان مرة واحدة يوميًا.					
54	أنا أنظف لساني.					
55	أستخدم طرقًا أخرى غير معجون الأسنان وفرشاة الأسنان لتنظيف فمي:					
	مسحوق السليكا					
	السواك					
	إصبع ومعجون					
	اشطفه بالماء المالح					
	اشطفه بالأعشاب					
	يشطف بالماء فقط					
56	اعتدت أن أزور طبيب أسنان مرتين في السنة للفحص .					

Annex (5): DMFT AND CPI (Clinical examination sheet).

Dentition status

	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Crown																
Root																
Crown																
Root																
	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

Permanent teeth

Status

0 = Sound
1 = Caries
2 = Filled w/caries
3 = Filled, no caries
4 = Missing due to caries
5 = Missing for any another reason
6 = Fissure sealant
7 = Fixed dental prosthesis/crown abutment, veneer, implant
8 = Unerupted
9 = Not recorded

Periodontal status (CPI Modified)

	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Bleeding																
Pocket																
Bleeding																
Pocket																
	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

Index teeth

17/16	11	26/27

47/46 31 36/37

Annex (6): Interview guiding questions

بسم الله الرحمن الرحيم

1. ممكن لو سمحت معلومات شخصيه عن حضرتك؟ (العمر – مكان السكن– كم سنه تعاني من مرض السكري، .....)
2. ممكن لو سمحت تحكي لي عن صحتك: كيف ترى صحتك بشكل عام، كيف حال صحة الفم عندك والاسنان، إذا في مشاكل بالفم والاسنان عندك اوصف لي من ماذا تشتكي وكيف تعاني؟
3. ممكن تحكي لي عن العلاقة بين مرض السكري ومشاكل الفم والاسنان، كيف ترى تأثير السكري على صحة اسنانك وفمك؟
4. راح نحكي الان عن كيف تعتني بالفم والاسنان. ممكن تحكي لنا ماذا يلزم للشخص ان يفعل لكي يحافظ على اسنانه والفم نظيفا؟
5. ممكن نعرف منك أكثر تفصيلا عن نفسك، يعني هل انت ملتزم بهذه الخطوات، هل ترى ان هذا يكفي؟ لماذا؟
6. ممكن نعرف من حضرتك ماهي الخدمات الصحية المتعلقة بالأسنان والفم اللي بقدمها المركز الكم؟
7. كيف تصف الرعاية المقدمة في وحدات رعاية الاسنان؟ هل تعتبرها كافة؟ من وجهة نظرك ما هي اوجه القصور في الخدمة والى اي مدي أثر ذلك على رعاية فمك واسنانك؟
8. هل تعتقد ان لديك معلومات كافية عن كيفية الرعاية بالفم والاسنان؟ لماذا تعتقد ذلك؟ ممكن تشرح أكثر؟؟ ماهي مصادر معلوماتك؟ ممكن توضيح؟
9. ممكن تحكلي لنا ما رأيك بالمعلومات التي تقدم لك بالمركز الصحي وخاصة طبيب الاسنان كي تحافظ على نظافة الاسنان والفم؟
10. ممكن يقدموا أكثر من ذلك؟ إذا نعم مثل ماذا؟
11. راح نتكلم الآن عن المتابعة في المركز الصحي. ممكن لو سمحت تحكي لنا رأيك عن المتابعة إذا كان عندك مشاكل بالفم والاسنان؟ برأيك الذي يقدموه كاف ولا ممكن يقدموا أكثر من ذلك؟ مثل ماذا؟
12. حابين نسمع منك ما الذي تغير في نمط حياتك وسلوكياتك عندما أصبت بمضاعفات مرض السكري على الأسنان والفم (التغذية، التدخين، ....)
13. الآن رأيك بالموضوع يهمنا كثيرا. حابين نسمع منك عن اهتمامك بالمتابعة عند طبيب الاسنان هل عندما عرف الطبيب أنك مريض سكري، شعرت أن اهتمامه تغير معك؟ كيف ممكن توضح
14. هل لديك توصيات إضافية؟ ماهي احتياجاتك كمريض سكري من المركز الصحي؟

الباحثة/ عائشة محمد فتيحة

Annex (7) Reliability of the questionnaire

Domain		Alpha cronbach (α)	
1. HBM		0.64	
• Perceived susceptibility to oral complication from T2DM • Perceived severity of oral complications from T2DM • Perceived benefits from oral health practices • Perceived barriers to oral health practices		0.70 0.61 0.89 0.66	
2. Awareness on oral complication from T2DM		0.62	
3. Oral health practices		0.61	
Domain	**Pearson correlation (r)**	**ICC**	**P-values**
1. HBM	0.962	.0981	< 0.0001
• Perceived susceptibility to oral complication from T2DM	0.831	0.907	< 0.0001
• Perceived severity of oral complications from T2DM	0.968	0.982	
• Perceived benefits from oral health practices	0.673	0.803	
• Perceived barriers to oral health practices	0.937	0.965	
2. Awareness on oral complication from T2DM	0.990	0.994	< 0.0001
3. Oral health practices	0.904	0.947	< 0.0001

Annex (8): Content validity of the questionnaire

item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6	Rater 7	Rater 8	Rater 9	I-CVI	pc*	*k*	interpretation
I am at risk for developing dental caries	4	4	4	4	4	4	3	3	3	1	0.002	1	Excellent
Because I am diabetic patient, I am riskier to develop oral diseases than others	1	3	3	4	4	4	2	4	3	0.78	0.070	0.79	Excellent
My teeth are healthy because i don not suffer from dental pain	4	3	4	4	4	4	4	3	3	1	0.002	1	Excellent
Although I have DM, my good health status protects me from getting oral complications.	4	3	4	4	4	4	3	3	3	1	0.002	1	Excellent
I am at higher risk of getting oral complications because of family history of oral complications resulted from DM.	4	2	4	4	4	4	3	4	3	0.89	0.014	0.89	Excellent
Perceived susceptibility to oral complications (S-CVI: 0.934)													
Oral diseases are not curable once diagnosed.	4	3	4	4	4	4	3	2	3	0.89	0.014	0.89	Excellent
Oral complications if occur result in deterioration of my general health and early death.	4	3	3	4	4	4	4	3	3	1	0.002	1	Excellent
The thought of getting oral complications scares me.	4	4	2	1	4	4	4	3	3	0.78	0.070	0.79	Excellent
If I got oral complications, my physical status would badly change.	4	2	3	3	4	4	4	4	3	0.89	0.014	0.89	Excellent
Getting oral complications will affect my social relationship (cannot laugh, interact and speak with others,…)	4	3	4	4	3	4	1	4	3	0.89	0.014	0.89	Excellent
Getting oral complications will bring heavy economic burden to me and my family.	4	4	3	4	4	4	1	4	3	0.89	0.014	0.89	Excellent

item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6	Rater 7	Rater 8	Rater 9	I-CVI	pc*	*k*	interpretation
Developing oral complications would be more serious than other diseases	4	4	3	4	4	4	1	3	3	0.89	0.014	0.89	Excellent
Perceived severity of oral complications (S-CVI: 0.89)													
Oral hygiene is necessary even if I have no oral symptoms.	4	4	2	4	4	4	4	4	4	0.89	0.014	0.89	Excellent
Oral hygiene practices help in prevention of oral complications	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
Early detection oral complications provides good chance for therapy.	4	4	3	4	1	4	4	4	4	0.89	0.014	0.89	Excellent
Routine dental checkup decreases opportunities of oral complications occurrence.	4	4	4	4	1	4	4	4	4	0.89	0.014	0.89	Excellent
Perceived benefits from oral health practices (S-CVI: 0.917)													
I fear sitting on dental chair	4	4	1	4	4	4	1	4	3	0.78	0.070	0.79	Excellent
Dental brush bleeds my gum	4	3	4	4	4	4	4	4	3	1	0.002	1	Excellent
I have limited access to information on oral hygiene practices.	4	3	2	4	4	4	3	4	3	0.89	0.014	0.89	Excellent
I cannot afford the costs of dental checkup	4	4	4	4	4	4	4	4	3	1	0.002	1	Excellent
Perceived barriers to oral health practices (S-CVI: 0.917)													
diabetic patients require to care more often than non-diabetics for their teeth and mouth	4	4	2	4	4	4	4	3	3	0.89	0.014	0.89	Excellent
Having T2DM results in oral bacterial infection	4	4	4	4	4	4	4	4	4	0.89	0.014	0.89	Excellent
Diabetics have gum problems more often if their blood sugar is uncontrolled	4	3	4	2	4	4	4	3	4	0.89	0.014	0.89	Excellent

item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6	Rater 7	Rater 8	Rater 9	I-CVI	pc*	*k*	interpretation
Oral problems associated with diabetes: • Dryness of the mouth • Gum bleeding on brushing • Mouth ulcers • Bad odor • Dental caries • Fungal mouth infection • Loose teeth • Taste problem • Burning sensation	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
Diabetic smokers have more serious gum disease than nonsmokers	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
T2DM causes delayed wound healing at dental extraction sites	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
T2DM contributes more to development of dental abscess	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
Regular dental visits is more important for diabetic patients than non-diabetics	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
As a diabetic, poor oral health conditions affects badly the general health	3	3	3	4	3	3	2	3	4	0.89	0.014	0.89	Excellent
Awareness about complications of T2DM on oral health (S-CVI: 0.951)													
I brush my teeth twice a day	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
I use toothbrush and paste to clean my teeth	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
I brush my teeth for at least two minutes each time	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
I follow the modified Bass technique of brushing the teeth	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
I used to change toothbrush four times a year	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent

item	Rater 1	Rater 2	Rater 3	Rater 4	Rater 5	Rater 6	Rater 7	Rater 8	Rater 9	I-CVI	pc*	*k*	interpretation
I use mouthwash to preserve and keep my gum healthy	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
I remove interdental debris using dental floss or toothpick once a day	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
I clean my tongue	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
I used to visit a dentist, for checkup, twice a year	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
Other methods than toothpaste and toothbrush to clean the mouth: • Silica powder • Miswak • Finger and paste • Rinse with salty water • Rinse with herbs • Rinse with water only	4	4	4	4	4	4	4	4	4	1	0.002	1	Excellent
Oral health practices (S-CVI: 1.00)													

Annex (9): Ethical approval from Helsinki Committee

المجلس الفلسطيني للبحث الصحي

Palestinian Health Research Council

تعزيز النظام الصحي الفلسطيني من خلال مأسسة استخدام المعلومات البحثية في صنع القرار

Developing the Palestinian health system through institutionalizing the use of information in decision making

Helsinki Committee

For Ethical Approval

Date: 15\02\2021 **Number:** PHRC/HC/858/21

Name: Aisha Fteha الاسم:

We would like to inform you that the committee had discussed the proposal of your study about: نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم حول:

Oral Health Status among Type II Diabetes Mellitus Patients attending governmental primary health centers

The committee has decided to approve the above mentioned research. Approval number PHRC/HC/858/21 in its meeting on 15\02\2021 و قد قررت الموافقة على البحث المذكور عاليه بالرقم والتاريخ المذكوران عاليه

Signature

Member **Member**

Chairman

23 2 2021

Genral Conditions:-

1. Valid for 2 years from the date of approval.
2. It is necessary to notify the committee of any change in the approved study protocol.
3. The committee appreciates receiving a copy of your final research when completed.

Specific Conditions:-

E-Mail:pal.phrc@gmail.com

Gaza - Palestine غزة - فلسطين

شارع النصر - مفترق العيون

Annex (10): Permission from the ministry of health

State of Palestine
Ministry of health

دولة فلسطين
وزارة الصحة

السيد : رامي عيد العبادله المحترم

التاريخ:28/04/2021
رقم المراسلة 686506

مدير عام بالوزارة /الإدارة العامة لتنمية القوى البشرية/وزارة الصحة

السلام عليكم ,,,

الموضوع/ تسهيل مهمة الباحثة/ عائشة فتيحة

التفاصيل //
بخصوص الموضوع أعلاه، يرجي تسهيل مهمة الباحثة/ **عائشة محمد فتيحة (طبيب اسنان)**
الملتحقة ببرنامج ماجستير الادارة الصحية – مسار الجودة وسلامة المريض – كلية الصحة العامة ـ جامعة القدس – فرع غزة في إجراء بحث بعنوان:
"Oral Health Status Among Type II Diabetes Mellitus Patients Attending Governmental Primary Health Centers at Gaza Governorate"
حيث الباحثة بحاجة لتعبئة استبانة وعقد لقاءات معمقة وعمل تقييم للصحة السنية لعدد من مرضى السكر النوع الثاني المترددين على عيادات الامراض المزمنة في مراكز الرابة الاولية (مركز شهداء الرمال –مركز شهداء بيت لاهيا – مركز شهداء دير البلح – مركز شهداء خانيونس – مركز شهداء رفح).
نأمل توجيهاتكم لذوي الاختصاص بضرورة الحصول على الموافقة المستنيرة من المرضى الذين هم على استعداد للمشاركة في البحث ومن ثم تمكين الباحثه من التواصل معهم ، بما لا يتعارض مع مصلحة العمل وضمن أخلاقيات البحث العلمي، ودون تحمل الوزارة أي أعباء أو مسئولية.
وتفضلوا بقبول التحية والتقدير،
1. البحث حاصل على موافقة لجنة اخلاقيات البحث الصحي (لجنة هلسنكي)
2. تسهيل المهمة الخاص بالدراسة أعلاه صالح لمدة 9 أشهر من تاريخه.
3. مرفق صورة عن اجازة ممارسة مهنة طب الاسنان للباحثة

محمد ابراهيم السرساوي
مدير دائرة/الإدارة العامة لتنمية القوى البشرية

التحويلات

▪ محمد ابراهيم محمد السرساوي(مدير دائرة)	← رامي عيد سليمان العبادله(مدير عام بالوزارة)	إجراءاتكم بالخصوص(28/04/2021)
▪ رامي عيد سليمان العبادله(مدير عام بالوزارة)	← ماهر محمود عبد الهادي شامية(مدير عام بالوزارة)	إجراءاتكم بالخصوص(28/04/2021)
▪ رامي عيد سليمان العبادله(مدير عام بالوزارة)	← ماهر محمود عبد الهادي شامية(مدير عام بالوزارة)	إجراءاتكم بالخصوص(28/04/2021)

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Annex (11): List of experts validated the tool.

No.	Name	Affiliation
1.	Dr. Mutassim Salah	PhD, Ministry of Health
2.	Dr. Mazen Abu Gamar	PhD, Al Azhar University, Gaza
3.	Dr. Mahmoud Radwan	PhD, Ministry of Health
4.	Dr. Yousef Awad	PhD, Ministry of Health
5.	Dr. Hamza Abd-Eljawad	PhD, Ministry of Health
6.	Dr. Ezat Askari	PhD, Israa University, Gaza
7.	Dr. Iyad Shaqoura	PhD, Ministry of Health
8.	Dr. Yeha Abed	PhD, MD, School of public Health, Al Quds University
9.	Dr. Bassam Abu Hamad	PhD, MD, School of public Health, Al Quds University
10.	Dr. Hazem Melad	PhD, School of Dentistry, Al Azhar University,Gaza
11.	Dr. Wassem Mushtha	PhD, School of Dentistry ,Al Azhar University, Gaza

Annex (12) Post Hoc tables

Annex 12.1 : Post Hoc test of mean difference DMFT index among smoking status (n = 376)

Smoking status		Mean Difference Crown	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Yes	No	1.47	1.01	0.146	-0.52	3.47
	Ex-smoker	-1.6	1.38	0.230	-4.39	1.06
No	Ex-smoker	-3.1	1.08	0.004*	-5.26	-1.02

M: mean, SD: standard deviation

Annex 12.2 : Post Hoc test of mean differences of perceived severity of oral complications with regard to age. (n = 376)

Dependent Variable			Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Perceived severity of oral complications (Max=5)	50 or less	51-55	0.10	0.07	0.182	-0.05	0.24
		56-60	0.13	0.07	0.068	-0.01	0.27
		61-65	0.10	0.07	0.148	-0.04	0.25
		More than 65	0.25*	0.07	0.000**	0.11	0.39
	51-55	50 or less	-0.10	0.07	0.182	-0.24	0.05
		56-60	0.03	0.07	0.660	-0.11	0.18
		61-65	0.01	0.08	0.917	-0.14	0.16
		More than 65	0.15*	0.07	0.036*	0.01	0.30
	56-60	50 or less	-0.13	0.07	0.068	-0.27	0.01
		51-55	-0.03	0.07	0.660	-0.18	0.11
		61-65	-0.02	0.07	0.737	-0.17	0.12
		More than 65	0.12	0.07	0.090	-0.02	0.26
	61-65	50 or less	-0.10	0.07	0.148	-0.25	0.04
		51-55	-0.01	0.08	0.917	-0.16	0.14
		56-60	0.02	0.07	0.737	-0.12	0.17
		More than 65	0.15*	0.07	0.045*	0.00	0.29
	More than 65	50 or less	-0.25*	0.07	0.000**	-0.39	-0.11
		51-55	-0.156	0.07	0.036*	-0.30	-0.01
		56-60	-0.12	0.07	0.090	-0.26	0.02
		61-65	-0.15*	0.07	0.045*	-0.29	0.00

M: mean, SD: standard deviation, **: P < 0.001, *: P < 0.05

دراسة حول حالة صحة الفم لدى مرضى السكري من النوع الثاني الذين يترددون على مراكز الصحة الأولية الحكومية في محافظة غزة.

إعداد: د. عائشه محمد فتيحة

إشراف: د. ايمن الصوص

ملخص الدراسة

خلفية البحث: مرض السكري هو مشكلة رئيسية تؤرق الصحة العامة وله تداعيات سيئة على صحة الفم ونوعية الحياة بشكل عام. هدفت هذه الأطروحة إلى فحص مشاكل صحة الفم واحتياجات مرضى السكري من النوع الثاني الذين يترددون على مراكز الصحة الأولية الحكومية في محافظات غزة.

منهجيه البحث: تم استخدام أسلوب النسق المختلط المتوازي في مايو 2021، وطبقت الدراسة الكمية المقطعية على 376 مريض بالسكري النوع الثاني حيث تم اختيارهم عشوائيا بالطريقة المنتظمة من 5 مراكز صحية أولية حكومية تم اختيارها عشوائيا. علاوة على ذلك، تم تجنيد 13 مريضا عن قصد لإجراء مقابلات معمقة في الجزء الكيفي من الدراسة. ثلاث أدوات رئيسية استخدمت لجمع البيانات: مؤشر صحة الأسنان التابع لمنظمة الصحة العالمية، استبيان شبه منظم وأسئلة مقابله. استخدم التحليل الوصفي والتحليلي والموضوعي على البيانات الكمية والكيفية على التوالي.

النتائج: اغلب المرضى (64%) يرون أنفسهم قابلين للإصابة بمضاعفات السكري على الفم و67.8% منهم يقر بخطورة هذه المضاعفات. ثلاث أرباع المرضى تقريبا (73.2%) يعتقدون بأهمية ممارسات نظافة الفم، في حين 56.2% ذكروا الكثير من المعيقات التي تمنعهم من اتباع نظافة الفم. أيضا 57.6% على علم بالمضاعفات التي يحدثها مرض السكري النوع الثاني ولكن 42% فقط ملتزمون بممارسات نظافة الفم.

مؤشر تسوس الأسنان كان 6.39±13.18، وكان متوسط الاسنان التي تعاني من انحصار اللثه هو 1.88±0.76 42.6% ليس لديهم التهاب دواعم الأسنان. على العكس، التهاب اللثة الشديد والمتوسط وجد عند 8.5% و 21.5% من المرضى على التوالي.

نزيف اللثة وانحصار اللثه أعلى بين الذكور والمدخنين السابقين والذين يعيشون في جنوب القطاع. مؤشر صحة الأسنان، النزيف اللثوي و انحصار اللثه مرتفع كثيرا عند المرضى الذين لديهم السكري اكثر من 10 سنوات، بينما متوسط الجيب اللثوي مرتفع عند المرضى الذين لديهم عدم انتظام السكري ومدة السكري اقل من 10 سنوات.

الخلاصة: يعاني مرضى السكري النوع الثاني من مشاكل فمية كثيرة. وأخيرا، إقامة الحملات التوعوية المجتمعية على مستوى الرعاية الأولية الحكومية وغير الحكومية لتعزيز وعي مريض السكري بأهمية ضبط السكري في الحفاظ على صحة الفم سليمة والعكس صحيح.