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Original article

Assessment of Oral Health Knowledge, Attitudes, and Practices Among Diabetic Patients: A Cross-Sectional Study in Gharyan, Libya

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abstract

The present study aimed to assess the knowledge of diabetic patients regarding diabetes-related systemic and oral complications and to evaluate their attitudes toward maintaining good oral health and their oral hygiene practices, including regular dental visits. A cross-sectional study was conducted at Gharyan Educational Hospital, Gharyan, Libya, between November 2025 and January 2026. A total of 134 diabetic patients attending scheduled outpatient clinics were enrolled. The study found that 60.5% of participants were aware that diabetes increases the risk of oral disease, with a high awareness of xerostomia (91%). However, knowledge of specific complications was lower; only 46.2% identified dental caries and 42.6% identified oral fungal infections as related risks. Regarding systemic health, patients showed higher awareness of diabetic foot and eye complications than of nerve or kidney complications. While 73.9% of participants reported brushing their teeth, only 41.8% did so twice daily. Furthermore, 44.8% visited the dentist less than once a year, and 41% could not remember their last visit. The primary sources of information were diabetologists (52.9%) and various media (50%), with 98.5% of participants expressing a desire for more education on this topic. Diabetic patients in Gharyan demonstrated a moderate level of knowledge regarding diabetes-related oral health. While attitudes toward oral hygiene are generally positive, there are significant gaps in knowledge regarding specific oral complications. The findings suggest an urgent need to integrate oral health education into routine diabetic care and to strengthen collaboration between physicians and dentists to improve overall patient outcomes.

Keywords. Diabetes mellitus, Oral Health, Knowledge, Attitude, Practice, Libya.

Introduction

Diabetes mellitus is a chronic metabolic disease characterized by sustained hyperglycemia (high blood glucose level) due to abnormalities in insulin secretion, insulin action, or a combination of both [1]. Prolonged or poorly controlled hyperglycemia exerts detrimental effects on overall health and is associated with severe systemic complications, including cardiovascular disease, retinopathy, nephropathy, and neuropathy, all of which contribute to increased morbidity and reduced life expectancy [2]. Diabetes mellitus represents a major global public health challenge, affecting an estimated 463 million adults worldwide in 2019, with projections indicating an increase to 700 million by 2045[3]. Libya bears a substantial and growing burden of the disease, with prevalence rates reported to be as high as 14% [4]. Furthermore, nearly half of individuals with diabetes in Libya remain undiagnosed or unaware of their condition [5]. These findings highlight the significant public health impact of diabetes in the country and emphasize the need for enhanced prevention, early detection, and disease management strategies [6,7].

Persistent hyperglycemia is associated with a variety of oral complications, including xerostomia, dental caries, burning mouth syndrome, delayed oral wound healing, gingivitis, and periodontitis [8]. Numerous studies demonstrate a reciprocal relationship between diabetes mellitus and periodontal disease, with diabetes raising the risk and severity of periodontitis and periodontitis worsening glycemic control by raising insulin resistance [9,10]. Moreover, people with diabetes are at increased risk of morbidity and mortality in the presence of severe oral infections [11]. The systemic pathways that connect diabetes and periodontal diseases, which are fueled by similar biological mechanisms including increased inflammatory responses and dysregulated immunological pathways, have been further highlighted by recent studies. Reviews indicate that this association extends beyond conventional dental health issues, and improving periodontal health may contribute to better glycemic control in diabetic patients [12,13].

Given this close relationship, improving patients' knowledge, attitudes, and practices (KAP) has become an essential component of comprehensive diabetes management. Adequate knowledge is a key determinant of health-related behaviors, and understanding diabetes-related oral complications is fundamental to adopting preventive measures, such as regular flossing and routine dental attendance [1,14]. These behaviors contribute to improved oral health and may support better glycemic control [15]. Although several international studies and a limited number of Libyan studies have evaluated oral health knowledge, attitudes, and practices among individuals with diabetes [16-18], the available evidence remains geographically limited.

To the best of our knowledge, no published study has specifically investigated these outcomes among diabetic patients in Gharyan, one of the major population centers in the Western Mountain region. Consequently, the oral health knowledge, attitudes, and practices of diabetic patients in this region remain poorly understood, limiting the availability of local evidence to support context-specific educational and preventive interventions. This study aimed to assess the knowledge of diabetic patients in Gharyan, Libya, regarding diabetes-related systemic and oral complications and to evaluate their attitudes toward maintaining good oral health and their oral hygiene practices, including regular dental visits. The findings

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provide baseline data that may inform the development of targeted oral health education strategies and preventive interventions to improve oral health outcomes among individuals with diabetes.

Methods

Study Design and Sample Size

This observational, cross-sectional study was conducted at the Gharyan Educational Hospital in Gharyan /Libya between November 2025and January 2026. From 140 diabetic patients attending scheduled appointments, 134 individuals (70 women, 64 men) were initially included, while 6 patients declined participation for personal reasons.

Inclusion/Exclusion Criteria

Individuals with a confirmed diagnosis of diabetes, regardless of age, were included in the study. Participants with comorbidities commonly associated with diabetes, such as hypertension, thyroid disorders, ischemic cardiopathy, and renal failure, were included, as these conditions are prevalent among individuals with diabetes and can influence oral health. However, individuals with severe cognitive impairments or psychiatric conditions that could hinder their ability to provide informed consent were excluded. Additionally, patients requiring hospitalization during the study period or those residing in institutional settings were excluded to maintain the accuracy and reliability of the collected data.

Data Collection

The researchers distributed a questionnaire sheet to potential participants, detailing the study's purpose and addressing any questions they had. Participation was voluntary, and individuals who met the inclusion criteria and agreed to join the study were given a consent form along with a self-administered questionnaire to complete while waiting for their medical appointment. Written consent was obtained from each participant, and it took approximately 8 to 15 min to fill out the questionnaire. The study questionnaire was carefully selected from relevant published reports in international journals. Demographic factors, including five variables—gender, age, duration of diabetes, smoking status, and education level—were evaluated at the start of the study for each participant. The questionnaire included targeted questions on systemic and common oral complications associated with diabetes. These questions assessed participants' awareness of potential complications, including gingival bleeding, swollen and erythematous gingiva, delayed wound healing, dry mouth (xerostomia), taste disturbances, and tooth decay. In addition, participants were asked whether they had received specific education on diabetes-related oral health. This structured approach enabled the assessment of both general awareness and specific knowledge regarding the relationship between diabetes and oral health.

Statistical Analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 17. Frequencies and percentages were calculated, and the data were presented as percentages of the total study population.

Results

A total of 134 patients participated in the study. Of these, 64 (47.8%) were male, and 70 (52.2%) were female. Regarding educational attainment, the largest proportions of participants (32.8% each) were illiterate or had a university education or above, whereas only 14.9% had a primary level of education. Among the participants, 30.6% were smokers. The largest proportion of participants (33.6%) had a diabetes duration of 4–10 years (Table 1).

Table 1. Distribution of diabetic participants according to sociodemographic characteristics

Characteristics	Number	Percentage
Sex		
Male	64	47.8%
Female	70	52.2%
Age (years)		
Less than15	9	6.7%
15-35	25	18.7%
35-55	42	31.3%
More than 55	58	43.3%
Education		
illiterate	44	32.8%
Primary	20	14.9%
Secondary	26	19.4%
University or above	44	32.8%
Smoking status		
Yes	41	30.6%
No	93	69.4%

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Duration of diabetes(years)		
Less than 4 years	20	14.9%
4-10	45	33.6%
10-20	38	28.4%
More than 20	31	23.1%

More than half of the participants (60.5%) were aware that individuals with diabetes are more prone to oral diseases. Less than half of the participants (46.2%) and (42.6%) knew that diabetes mellitus can cause dental caries and oral fungal infections, respectively. In addition, 60.4% of the participants were aware that diabetes affects the gingiva. The study also showed that more than half of the participants (54.5%) were aware that smoking is more harmful to gingiva in individuals with diabetes than in non-diabetic individuals (Table 2).

Table 2. Awareness about the effect of diabetes mellitus on oral health

Quires	Yes	No	Don't know
Diabetes increases the risk of oral disease	81(60.5%)	3(2.2%)	50(37.3%)
Diabetes mellitus leads to dental caries	62(46.2%)	8(6%)	64(47.8%)
Diabetes mellitus affects gingiva	81(60.4%)	51(38.1%)	2(1.5%)
Diabetes causes oral fungal infection	57(42.6%)	5(3.7%)	72(53.7%)
Is smoking more injurious to the gums of diabetics than non-diabetics?	73(54.5%)	4(3%)	57(42.5%)

The percentage of participants with knowledge of various systemic complications associated with diabetes; only about 47% of them know that Diabetes Mellitus affects the nerves. Most of the patients (69.4% and 68.7%) knew that Diabetes Mellitus affects the feet and eyes consequently (Table 3).

Table 3. Awareness about the complications of diabetes on body systems

Quires	Yes	No	Do not know
Effect of diabetes on the eyes	92(68.7%)	38(28.3%)	4(3%)
Diabetic foot	93(69.4%)	36(26.8%)	5(3.7%)
Effect of diabetes on the nerves	63(47%)	41(30.6%)	30(22.4%)
Effect of diabetes on the kidneys	65(48.5%)	60(44.8%)	9(6.7%)

Regarding the attitudes and practices of diabetic patients toward oral health, more than half of the participants (58.2%) reported that they would consult a dentist if they experienced an oral health problem. In contrast, only 5.2% preferred to consult a general physician. Most of the participants (73.9%) reported brushing their teeth. A higher proportion of participants (41.8%) brushed their teeth twice daily, whereas 33.6% brushed occasionally or did not brush their teeth (Table 4). When asked about the frequency of toothbrush replacement, 68.7% of the participants reported changing their toothbrush after more than 6 months, whereas 19.4% reported replacing it every 6 months. Regarding toothbrush bristle consistency, 38.1% of the participants used a medium-bristled toothbrush, while 29.1% were unaware of the bristle consistency of their toothbrush. Most of the participants used additional oral hygiene aids; among them, 79.9% used mouthwash, whereas 16.4% used toothpicks. Furthermore, 44.8% of the participants had last visited a dentist more than 1 year ago, while 41.0% could not recall their last dental visit. Almost all participants (98.5%) expressed an interest in receiving education about the effects of diabetes on oral health **(**Table 4).

Table 4. Oral hygiene practices among diabetic patients

Quires	number	Percentage %
In case of a mouth problem, patients:		
Consult a physician	7	5.2
Consult a dentist	78	58.2
Do self-remedy	18	13.4
Ignore it	31	23.1
Do you brush your teeth		
Yes	99	73.9
No	39	26.1
The frequency of teeth brushing		
After every meal	7	5.2
Twice daily	56	41.8
Once daily	26	19.4
Occasionally	45	33.6

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The frequency of changing a toothbrush		
Every 3months	16	11.9
Every 6months	26	19.4
More than 6 months	92	68.7
The type of toothbrush used		
Soft	43	32.1
Medium	51	38.1
Hard	1	0.7
Don't know	39	29.1
Other methods used for maintaining oral hygiene		
Dental floss	11	8.2
Tooth pick	22	16.4
Mouth wash	107	79.9
Nothing	4	3
The frequency of dentist visit		
Less than 6 months	6	4.5
6months-1 year	13	9.7
More than one year	60	44.8
Don’t remember	55	41
Do you want to get education about the effect of diabetes on oral health?		
Yes	131	98.5
No	2	1.5

In terms of the participants’ knowledge of diabetes-related oral complications, more than half (57.4%) were unaware that gingival bleeding is an oral complication associated with diabetes, whereas 91.0% were aware that dry mouth (xerostomia) is an oral complication associated with diabetes (Table 5). As for the participants’ sources of information about oral health, many reported receiving information from multiple sources. More than half (52.9%) received information from their diabetologist, 47.7% from a dentist, and 50.0% from other sources, such as newspapers, the internet, television, magazines, and radio (Table 6).

Table 5. Knowledge of diabetic patients about oral complications associated with diabetes

Quires	Yes	No	Do not know
Bleeding gums	57(42.5%)	31(23.1%)	46(34.3%)
Swollen red colored gingiva	55(41%)	31(23.1%)	48(35.8%)
Taste problem	24(17.9%)	53(39.6%)	57(42.5%)
Dryness of mouth	122(91%)	9(6.7%)	3(2.2%)
Tooth decay	71(52.9%)	25(18.7%)	38(28.4%)
Soreness of gingiva	69(51.5%)	21(15.7%)	44(32.8%)

Table 6. Patients' sources of information about their oral health

Sources of information	frequency
Dentist	64(47.7%)
Diabetologist	71(52.9%)
Family and friends	45(33.5%)
Newspaper, Internet. Television, Magazines, Radio	67(50%)

Discussion

To the best of our knowledge, this is the first study to evaluate self-reported oral health status, oral health knowledge, attitudes, and behaviors among individuals with diabetes in Gharyan, Libya. To address this gap, the present study employed a structured questionnaire to assess diabetic patients' knowledge, attitudes, and behaviors regarding oral health and its relationship with diabetes. The findings revealed a high level of awareness regarding the relationship between diabetes and oral complications, with more than half of the participants demonstrating adequate oral health knowledge related to diabetes. These findings contrast with those reported in studies conducted in Saudi Arabia (19,20). This difference may reflect variations in the study populations and access to oral health information. In the present study, participants reported obtaining oral health information from multiple sources, particularly diabetologists, dentists, and mass media, which may have contributed to the observed level of awareness.

A high proportion of participants (91%) correctly recognized dry mouth as an oral complication associated with diabetes, indicating a good level of knowledge regarding this condition. This awareness is clinically important, as xerostomia is a

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common oral manifestation of diabetes that may adversely affect oral health and quality of life and increase the risk of further oral complications [21,22]. Adequate patient awareness may facilitate earlier recognition of symptoms and encourage timely preventive and therapeutic measures.

An important finding of the present study is that participants' knowledge varied considerably across different oral complications associated with diabetes. Awareness was highest for dry mouth, with nearly 91% of participants recognizing it as a diabetes-related oral complication. In contrast, knowledge of other oral manifestations, including gingival inflammation, dental caries, fungal infections, and particularly taste disturbances, was comparatively lower. Xerostomia is one of the most common oral manifestations of diabetes and is primarily associated with reduced salivary flow [23]. Because saliva plays an essential role in maintaining oral health by cleansing the oral cavity and limiting plaque accumulation, reduced salivary flow may increase the risk of dental caries and periodontal disease [24,25]. These findings suggest that although awareness of dry mouth was high, patient education should place greater emphasis on improving knowledge of the broader range of oral complications associated with diabetes. The present study demonstrated that participants had greater awareness of the systemic complications of diabetes, such as diabetic retinopathy, nephropathy, neuropathy, and diabetic foot, than of its oral complications.

This finding may reflect the greater emphasis placed on systemic complications during routine diabetes education and clinical care. Similar findings have been reported by previous studies, which showed that diabetic patients were less aware of their increased risk of periodontal disease and placed less importance on oral health [23]. These findings underscore the need to integrate oral health education into routine diabetes management programs to improve patients' awareness of diabetes-related oral complications. Regarding oral hygiene practices, brushing the teeth twice daily was more commonly reported than brushing once daily among the participants. This finding is consistent with the study by Swati et al. [26], in which most participants also reported brushing their teeth twice a day. In contrast, studies by Apoorva et al. [27] and Ashish et al. [28] found that brushing once daily was the predominant practice among diabetic patients. These differences may reflect variations in oral health awareness, educational interventions, and oral hygiene practices across different study populations.

Dental attendance patterns observed in the present study indicated that a substantial proportion of participants reported that their last dental visit had been more than one year earlier, while many others were unable to recall when they had last visited a dentist. These findings suggest that regular dental attendance was suboptimal among the study population. Routine dental visits are essential for the early detection and management of diabetes-related oral complications. Therefore, greater efforts are needed to encourage individuals with diabetes to undergo regular dental examinations and to integrate oral health care into routine diabetes management. An encouraging finding of the present study was the strong interest expressed by participants in receiving education about the effects of diabetes on oral health, with 98.5% indicating a desire for further information. Participants also reported obtaining oral health information from multiple sources, including diabetologists, dentists, and mass media. These findings highlight valuable opportunities to strengthen patient education through coordinated efforts between medical and dental professionals, supported by reliable public health information.

Improving access to accurate oral health education may enhance patients' awareness, encourage appropriate oral hygiene practices, and facilitate the prevention and early management of diabetes-related oral complications [26]. One of the strengths of this study is that it provides important insights into oral health knowledge, attitudes, and behaviors among individuals with diabetes in Gharyan, Libya, where limited data are available on this topic. The use of a structured questionnaire allowed the assessment of multiple aspects related to patients' awareness and oral health practices, providing a broader understanding of their educational needs. This study has some limitations. First, the cross-sectional design limits the ability to establish causal relationships between diabetes-related factors and oral health knowledge or behaviors. Second, the use of self-reported questionnaire data may be subject to recall bias and social desirability bias. Finally, as the study was conducted in a single geographical area, the findings should be interpreted with caution when generalizing them to the broader diabetic population in Libya.

Conclusion

The level of knowledge and awareness of diabetes-related oral health among diabetic patients in Gharyan was moderate. Although many participants demonstrated a positive attitude toward maintaining oral hygiene, knowledge of diabetes-related oral complications remained limited. Awareness of the systemic complications of diabetes was generally high, particularly regarding its effects on the eyes and feet. Notably, almost all participants expressed a willingness to receive education about the impact of diabetes on oral health. These findings highlight the need to integrate oral health education into routine diabetes care and strengthen collaboration between physicians and dentists to improve patients' awareness, promote preventive oral health practices, and support better oral health and diabetes management. Further multicenter studies are warranted to confirm these findings across different regions of Libya.

Conflict of interest. Nil

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