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Evaluation of Awareness, Practice and Periodontal Health Assessment Among Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study

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Abstract:

- ***Introduction:***
  Diabetes mellitus, a leading global health concern, is strongly linked to poor oral health, with diabetics being 2–3 times more likely to develop periodontitis. This study aimed to assess the knowledge, awareness, and oral health practices of type 2 diabetes mellitus (T2DM) patients.

- ***Methodology:***
  A cross-sectional study was conducted among 396 T2DM patients at A.J. Institute of Dental Sciences, Mangalore. A structured questionnaire (in English and Kannada) assessed awareness of diabetes-related oral health issues. Clinical oral examinations were performed using the Gingival Index and Community Periodontal Index (CPI).

- ***Results:***
  Most participants were unaware of the link between diabetes and oral health. Dental visits were infrequent and mostly pain-driven. Regular check-ups and discussions with dentists about diabetes were uncommon.

- ***Conclusion:***
  There is a significant lack of awareness among diabetic patients regarding oral health. Education and regular dental care are essential to prevent complications like periodontitis in this high-risk group.

Keywords: *Type 2 Diabetes Mellitus; Periodontal Health; Oral Health Awareness; Gingival Index; Community Periodontal Index; Oral Hygiene Practices; Patient Education; Cross -Sectional Study; Diabetes-Periodontitis Relationship; Oral -Systemic Link.*

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I. INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic disorders marked by chronic hyperglycemia, affecting carbohydrate, fat, and protein metabolism. Type 2 diabetes mellitus (T2DM) arises from insulin resistance and progressive β-cell failure, commonly linked to obesity, aging, and inactivity. In India, the number of diabetics is projected to rise from 40.9 million to 69.9 million by 2025. Persistent poor glycemic control increases the risk of both systemic and oral complications. Diabetic patients are 2–3 times more likely to develop periodontitis. Studies show that individuals with HbA1c levels >9% have a higher prevalence of severe periodontal disease.

Periodontitis is a chronic inflammatory disease triggered by bacterial biofilm. It leads to the release of pro-inflammatory mediators (e.g., IL-1β, IL-6, TNF-α, MMPs), which contribute to tissue and bone destruction. Both DM and periodontitis share inflammation as a central mechanism. Advanced Glycation End-products (AGEs) in diabetics contribute to oxidative stress and impaired immune function, increasing susceptibility to periodontal infection. Bacterial endotoxins like lipopolysaccharides (LPS) further exacerbate

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inflammation and cause insulin resistance, worsening glycemic control.

Research shows that effective periodontal therapy can reduce HbA1c levels by decreasing systemic inflammation. This highlights the need to integrate periodontal care into diabetes management. Despite this, many diabetic patients remain unaware of the bidirectional relationship between diabetes and periodontal disease. Education and awareness are essential, as improved knowledge positively influences oral health behavior. The main aim of this current study: To evaluate the knowledge, awareness, and periodontal health maintenance among patients with type 2 diabetes mellitus.

II. METHODOLOGY

➢ *Study Design & Population:*

A cross-sectional study was conducted among 396 type 2 diabetes mellitus (T2DM) patients aged 30 years and above, visiting the Department of Periodontics at A.J. Institute of Dental Sciences, Mangalore.

- *Sampling Technique:*

Participants were selected using convenience sampling.

- *Inclusion Criteria:*

✓ Diagnosed T2DM patients aged ≥30 years
✓ Willing to participate

- *Exclusion Criteria:*

✓ Unwilling individuals
✓ Patients with other systemic diseases

➢ *Study Tools & Equipment:*

CPITN-C probe, mouth mirrors, tweezers, cotton rolls, kidney trays, disposable gloves, masks, glasses.

➢ *Data Collection:*

After obtaining ethical clearance and informed consent, a structured questionnaire (15 items in English and Kannada) was administered to assess knowledge and awareness of oral health in diabetes. This was followed by a clinical oral examination using the Gingival Index (Löe and Silness) and the Community Periodontal Index (CPI) to assess periodontal status.

➢ *Statistical Analysis:*

Categorical data were expressed as percentages. The chi-square test was used to assess differences in knowledge, awareness, and oral health status based on the Gingival Index (Löe and Silness) and Community Periodontal Index (CPI). A p-value < 0.005 was considered statistically significant.

III. RESULTS

The mean age of the study participants was 59 years, as shown in Table 1. Among the 396 participants, 67.67% were male and 32.32% were female, indicating a statistically significant male predominance (Graph 1). In terms of educational background, 47.98% were graduates, and 39.90% had attended school, reflecting a generally literate population (Graph 2, Table 2).

Regarding awareness and practices, most participants were unaware of the association between diabetes mellitus and oral or systemic complications (Graphs 3–14). While 70% recognized bleeding gums, only 45.45% were aware of tooth mobility and 19.69% identified bad breath as an issue. Notably, none of the participants were aware of altered taste sensation, and 34.84% were unaware of all three conditions—altered taste, bad breath, and mobility. Although 53.28% were unaware of dry mouth, this was not statistically significant. Additionally, the majority did not know that gum disease could be a complication of diabetes (Table 3).

In terms of dental care behavior, 75.75% visited the dentist only, when necessary, usually due to pain. Only 20.2% had routine dental checkups every six months. Visits for other issues like bleeding gums (5.05%), sensitivity (7.57%), tooth mobility (2.52%), and chewing problems (9.09%) were rare. Most participants did not discuss diabetes with their dentists, and no participants reported being referred to a dentist by a physician. Regarding oral hygiene habits, 98.4% used a toothbrush, but 94.94% did not use any interdental cleaning aids, and most brushed only once daily (Table 3).

Clinical assessment using the Gingival Index (Löe and Silness) revealed that 52.02% had mild gingivitis and 47.97% had moderate gingivitis, with no cases of severe gingivitis. These findings were statistically significant (Graph 15, Table 4).

The Community Periodontal Index (CPI) findings showed that 47.85% had periodontal pockets of 4–5 mm, 24.30% had pockets ≥6 mm, and 20.25% presented with calculus. Additionally, 2.02% had a periodontal abscess. In terms of attachment loss, 47.85% had a loss of 4–5 mm, and 27.85% had a loss of 6–8 mm (Graphs 16–18, Table 5).

Table 1 Assessment of Age Among Study Population

Parameters	Mean and standard Deviation
Age in years (in terms of mean and standard deviation)	59.76±14.80

Table 2 Assessment of Gender Distribution & Education Status Among Study Population

Parameters	Frequency and percentage	P-value
Gender	268 (67.67%)	
Male	128 (32.32%)	0.00000001989

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Female		
Education status School Graduate Illiterate	158 (39.90%) 190 (47.98%) 48 (12.12%)	0.0000022

P <0.05 is Considered as Statistically Significant

Table 3 Assessment of Awareness and Practice of Study Population in Relation to Various Questions of the Study Using Chi-Square Test

Questions	Responses	Frequency and Percentage	p- value
ASSESSMENT OF AWARENESS AMONG STUDY POPULATION			
Comparison of knowledge regarding the correlation between diabetes mellitus and systemic and oral complications	Yes NO	50 (12.63%) 346 (87.37%)	0.000000212
Presence of bleeding gums among study population	Yes No	280 (70.70%) 116 (29.3%)	0.000000821
Oral problems commonly Encountered by the study Population	Tooth mobility Bad breath Altered taste sensation None of the above	180 (45.45%) 78 (19.69%) 0 138 (34.84%)	0.000000002257
Presence of dryness of Mouth among study	Yes No	185 (46.71%) 211 (53.28%)	0.1914
Population knowledge that Diabetes causes gum Problems among study Population	Yes No	78 (19.69%) 318 (80.30%)	0.00000121
ASSESSMENT OF PRACTICE AMONG STUDY POPULATION			
Frequency of dental visits by the study population	Once in six months Once in a year Only when it is needed Never	80 (20.2%) 0 300 (75.75%) 4 (1.01%)	0.00000000000022
Communication about Diabetes with dentist Among study	Yes No	100 (25.25%) 296 (74.74%)	0.0000000000223
Complaints leading to most dental visits by the study population	Pain Bleeding Gums Sensitivity Mobility Difficulty in chewing	300 (75.75%) 20 (5.05%) 30 (7.57%) 10 (2.52%) 36 (9.09%)	0.00000000022
Referral to the dentist by physician among study population	Yes No	390 (98.4%) 6 (1.51%) 0 0	0.00000000000046
Brushing frequency among study Population	Once a day Twice a day Occasionally None of the above	390 (98.4%) 6 (1.51%) 0 0	0.00000000000046
Mode of oral hygiene followed among study population	Toothbrush Fingers Wooden Stick None of the above	390 (98.4%) 0 5 (1.26%) 1 (0.25%)	0.00000000000043
Use of inter dental cleaning aids among study population	Yes No	20 (5.05%) 376 (94.94%)	0.00000000000082

P <0.05 is considered as statistically significant

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Table 4 Assessment of Gingival Bleeding Index Among Study Population

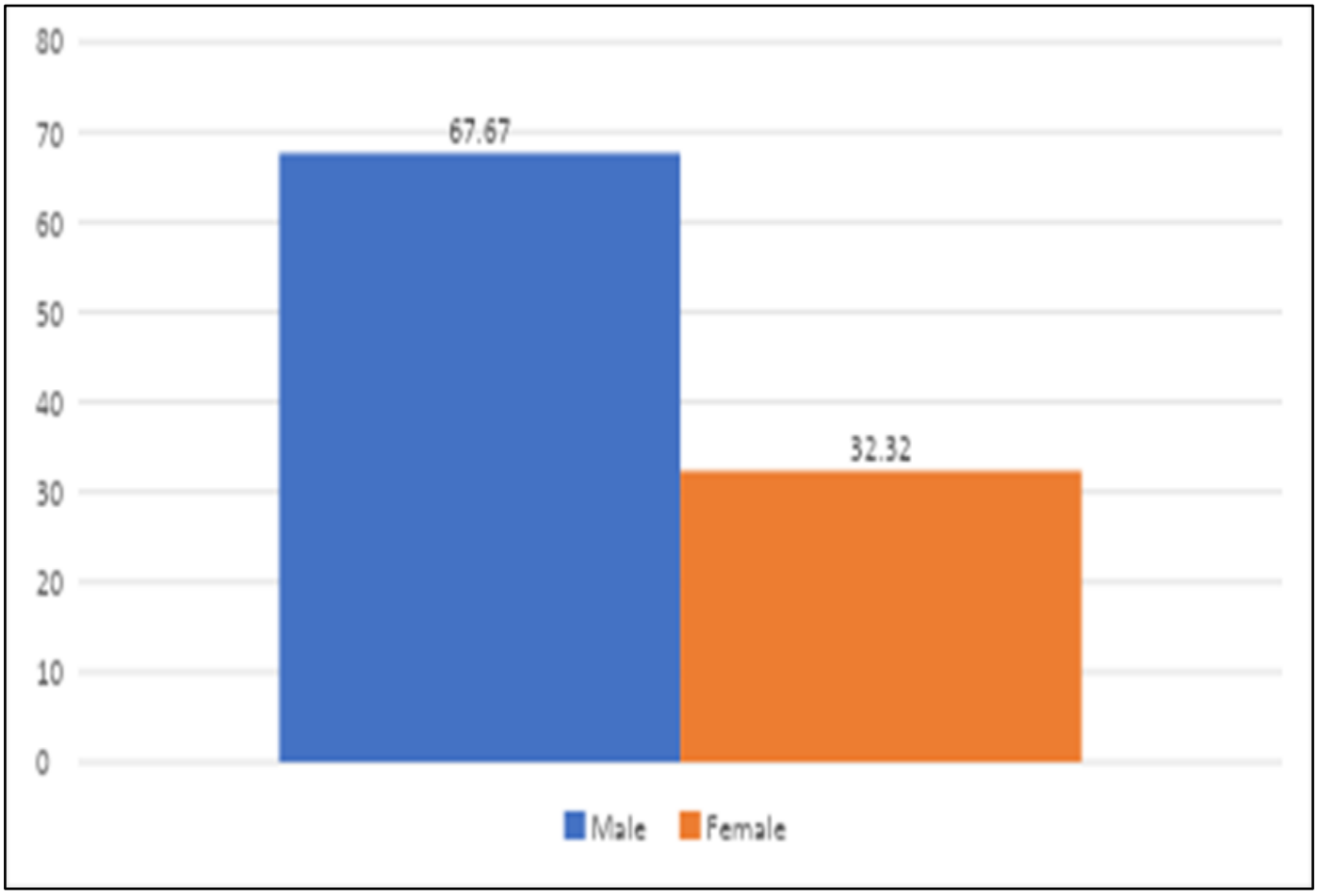
Parameters	Mean	Mild	Moderate	Severe	p- value
Gingival bleeding index score (in terms of mean and standard deviation)	0.863±0.558	206 (52.02%)	190 (47.97%)	0	0.00000059

P <0.05 is considered as statistically significant

Table no.5 – Assessment of Abscess and Community periodontal index among study population using chi square test

Parameters	Frequency and percentage	P-value
Abscess Present Absent	8 (2.02%) 387 (97.72%)	0.000000000000973
CPI Score Score 0 Score 1 Score 2 Score 3 Score 4	 13 (3.29%) 17 (4.30%) 80 (20.25%) 189 (47.85%) 96 (24.30%)	0.00000000566
Loss of attachment Score 0 Score 1 Score 2 Score3 Score 4	110 (27.85%) 189 (47.85%) 95 (24.05%) 0 1 (0.25%)	0.000000000043

➢ *Graphs*



Graph 1 Gender Distribution Among Study Population in Percentage

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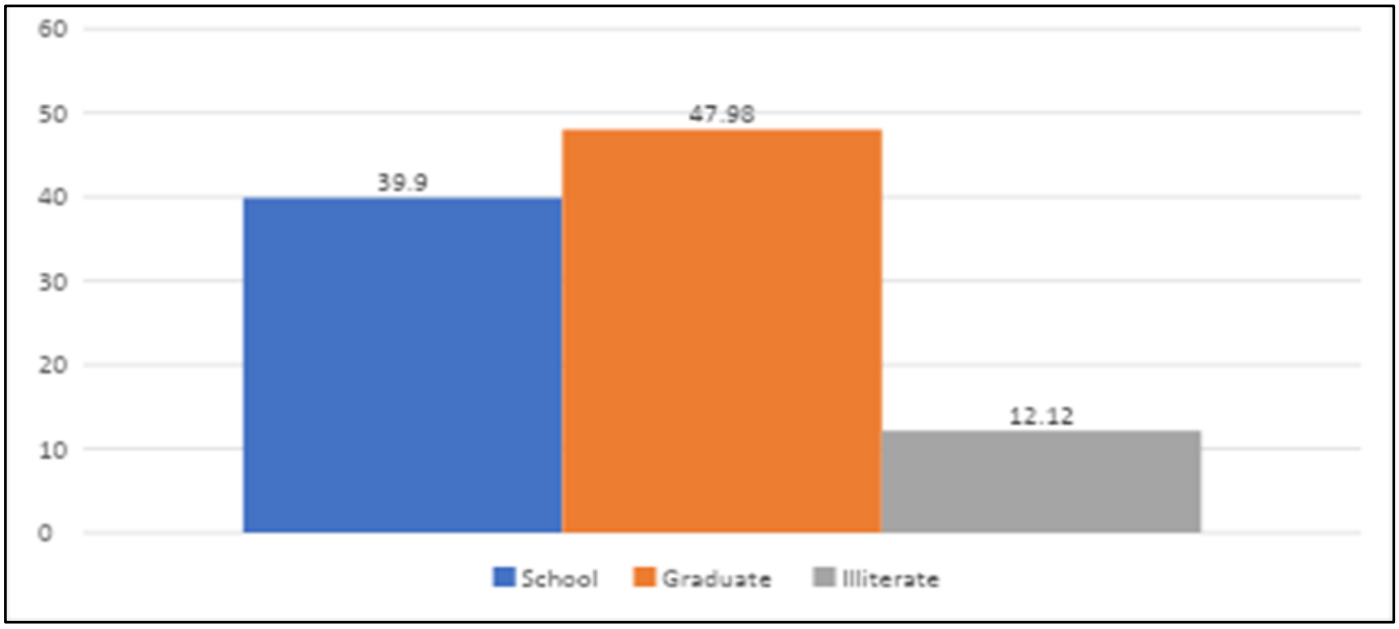
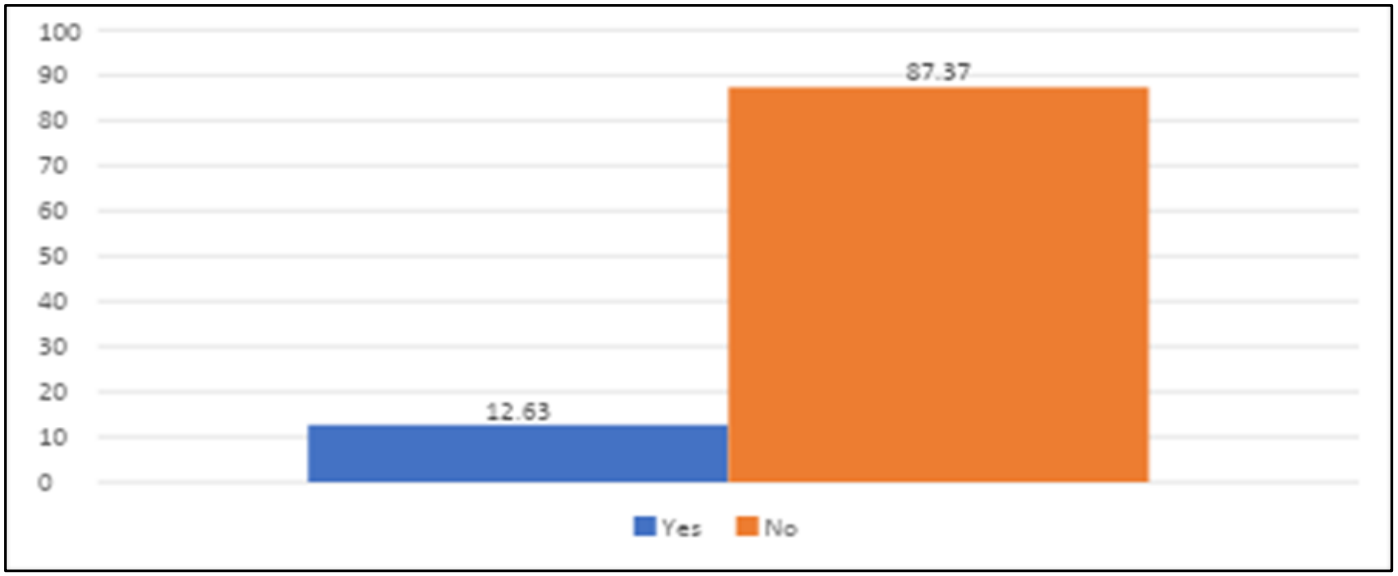
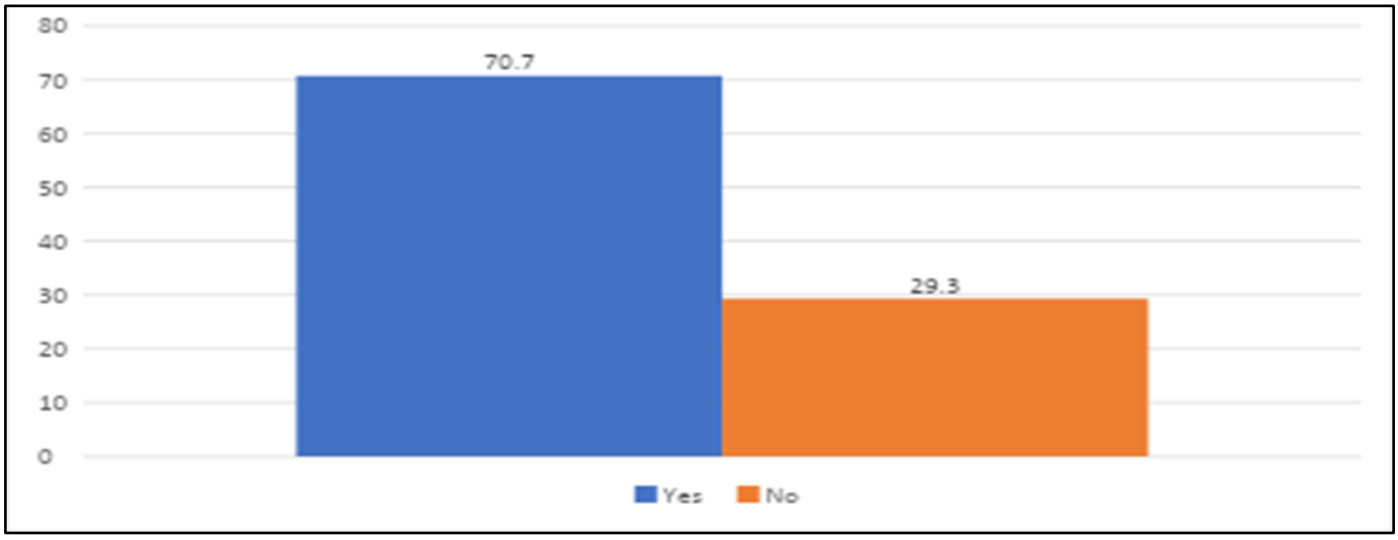


Graph 2 Education Status Among Study Population in Percentage



Graph 3 Comparison of Awareness About Association of Diabetes Mellitus with Oral and Systemic Complications in Percentage



Graph 4 Presence of Bleeding Gums Among Study Population in Percentage

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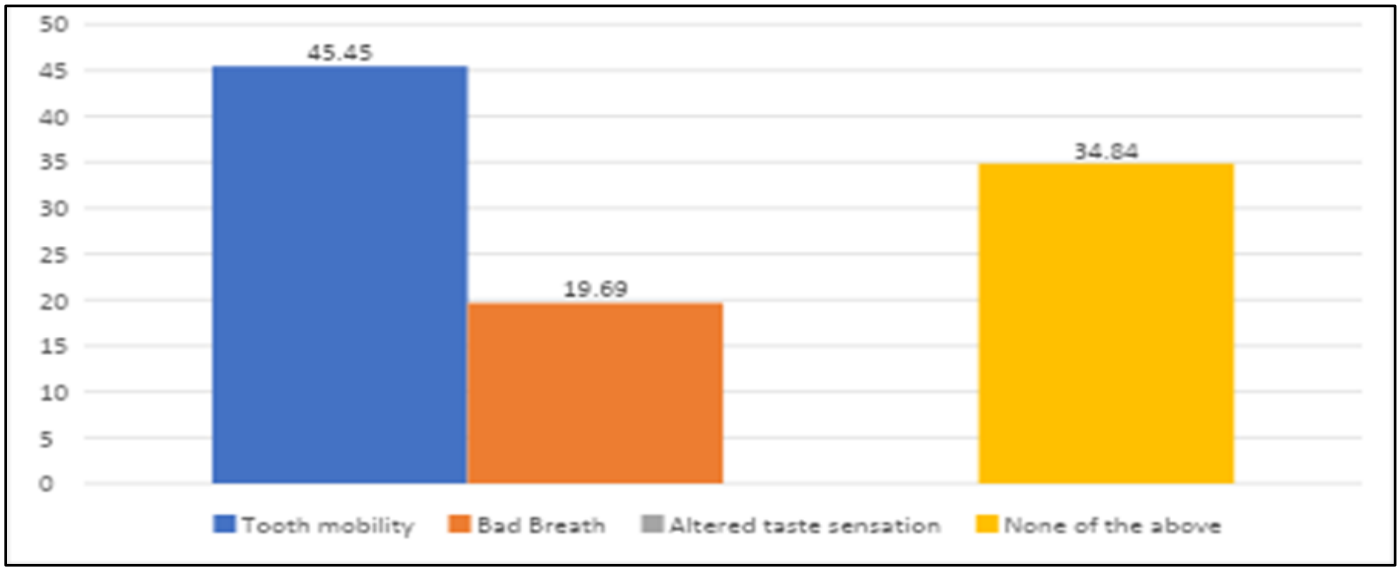
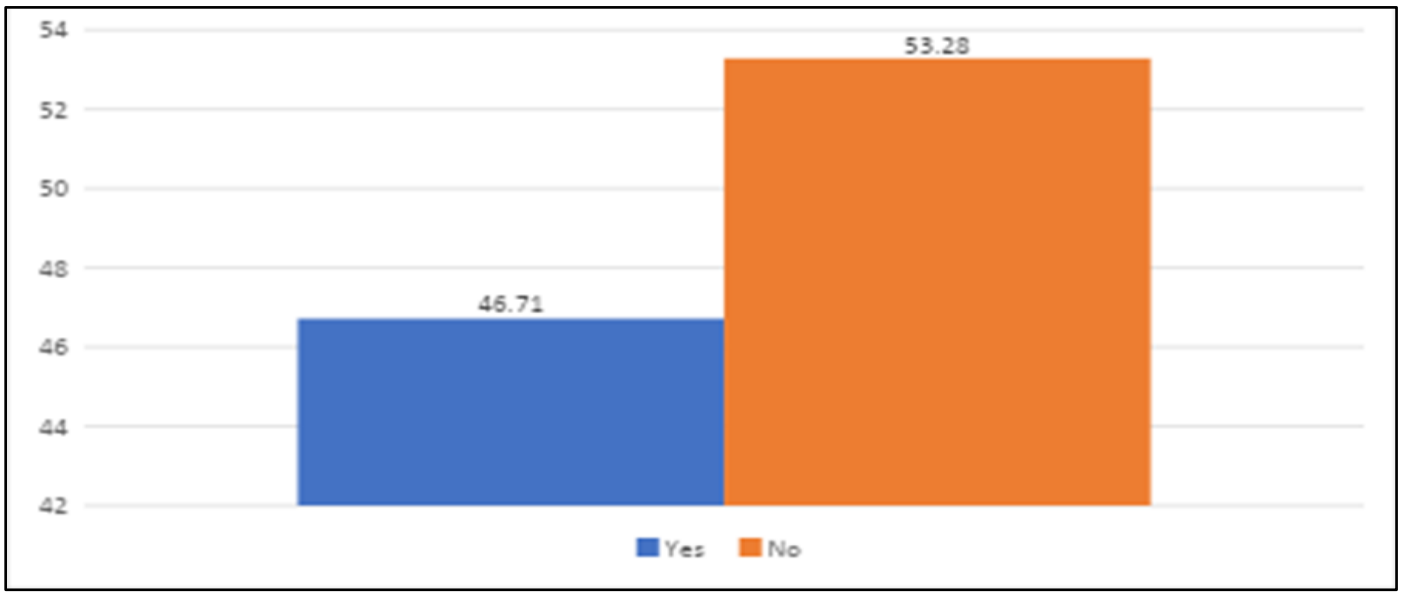
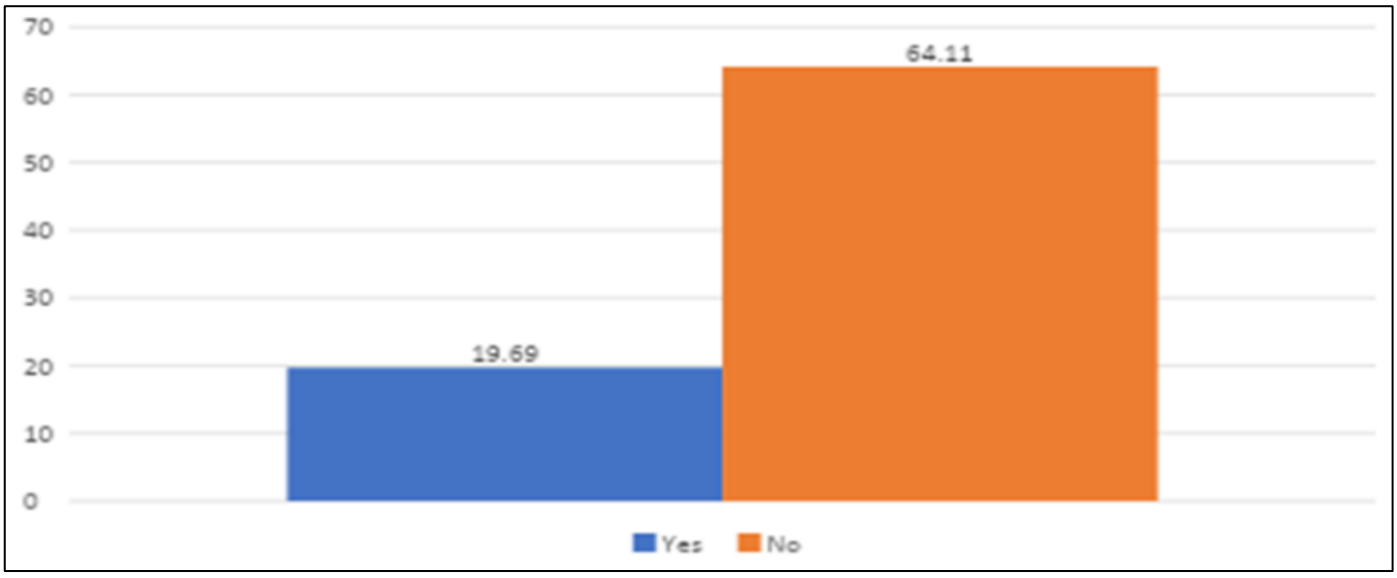


Graph 5 Oral Problems Commonly Encountered by the Study Population in Percentage



Graph 6 Presence of Dryness of Mouth Among Study Population in Percentage



Graph 7 Knowledge that Diabetes Causes Gum Problems Among Study Population in Percentage

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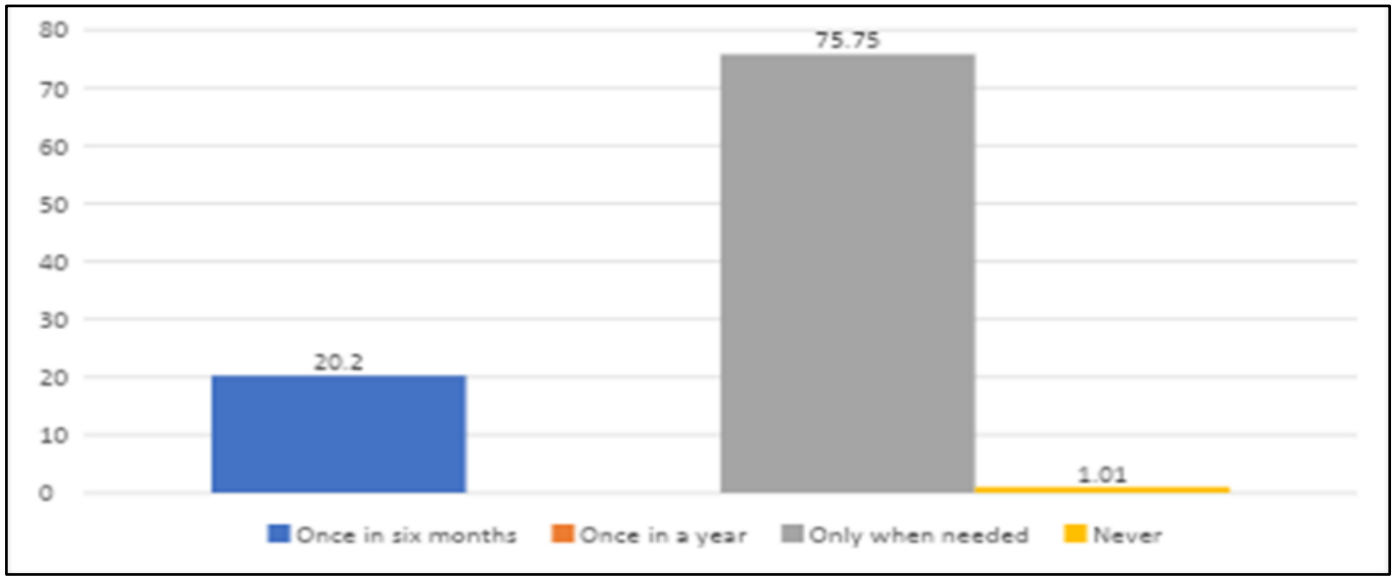
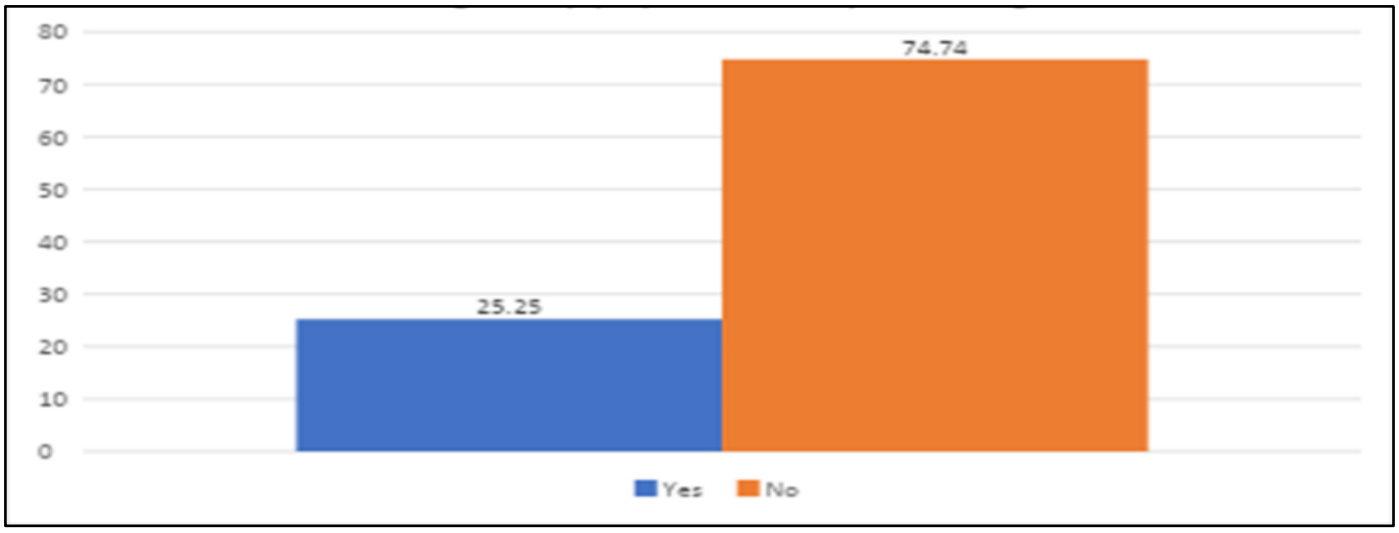
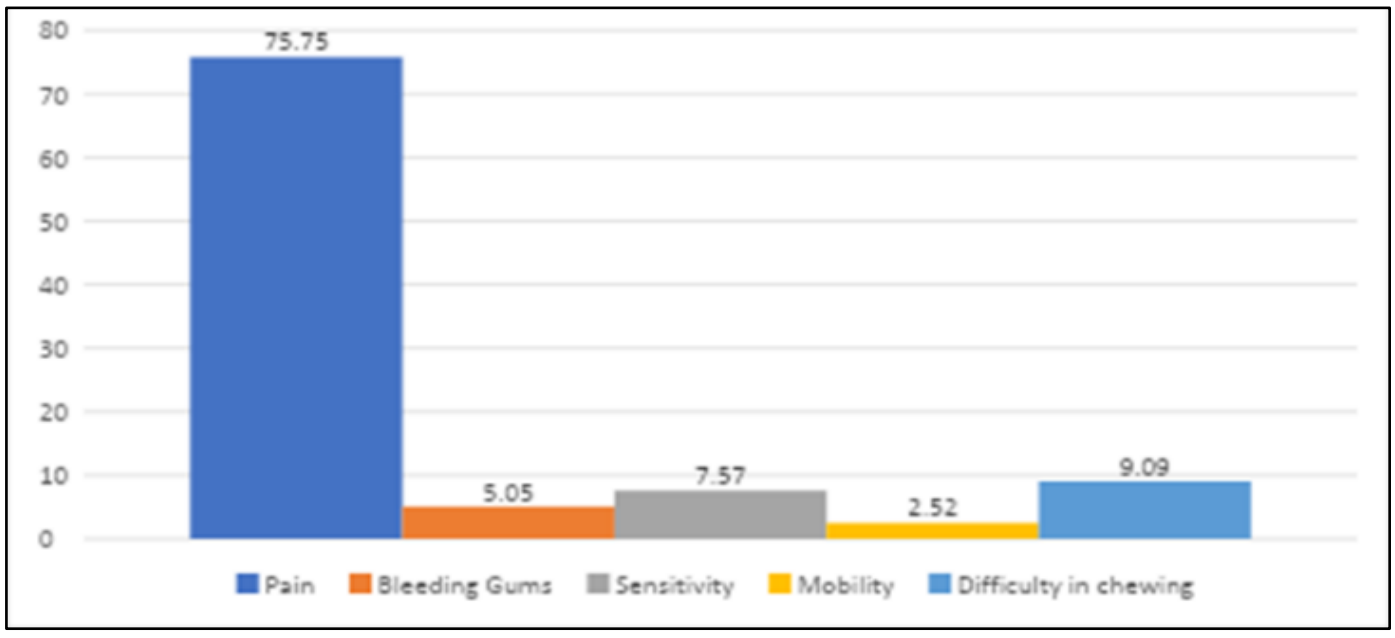


Graph 8 Freuqency of Dental Visits by the Study Population in Percentage



Graph 9 Communication About Diabetes with Dentist Among Study Population in Percentage



Graph 10 Complaints Leading to Most Dental Visits by the Study Population in Percentage

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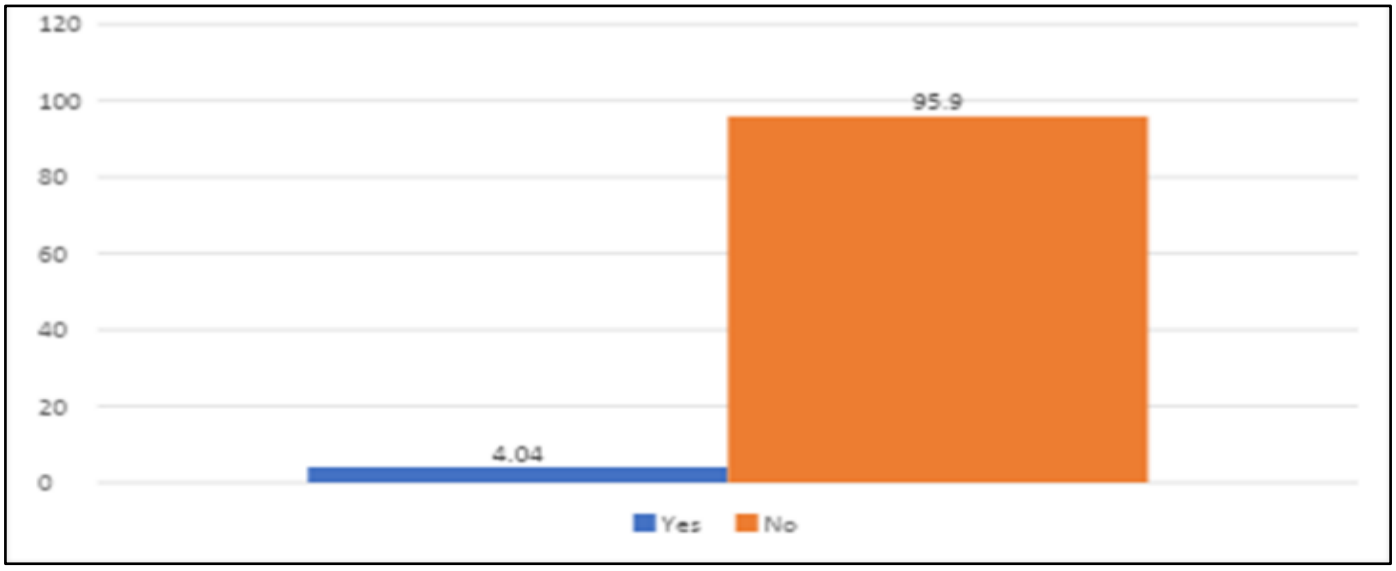
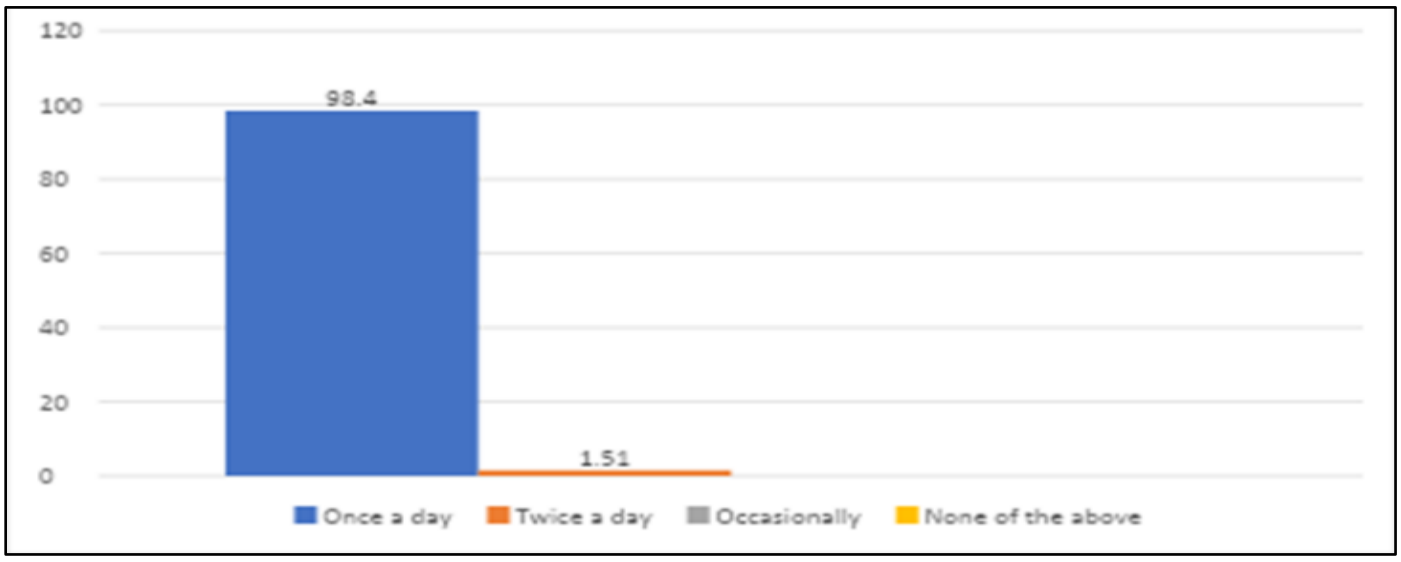
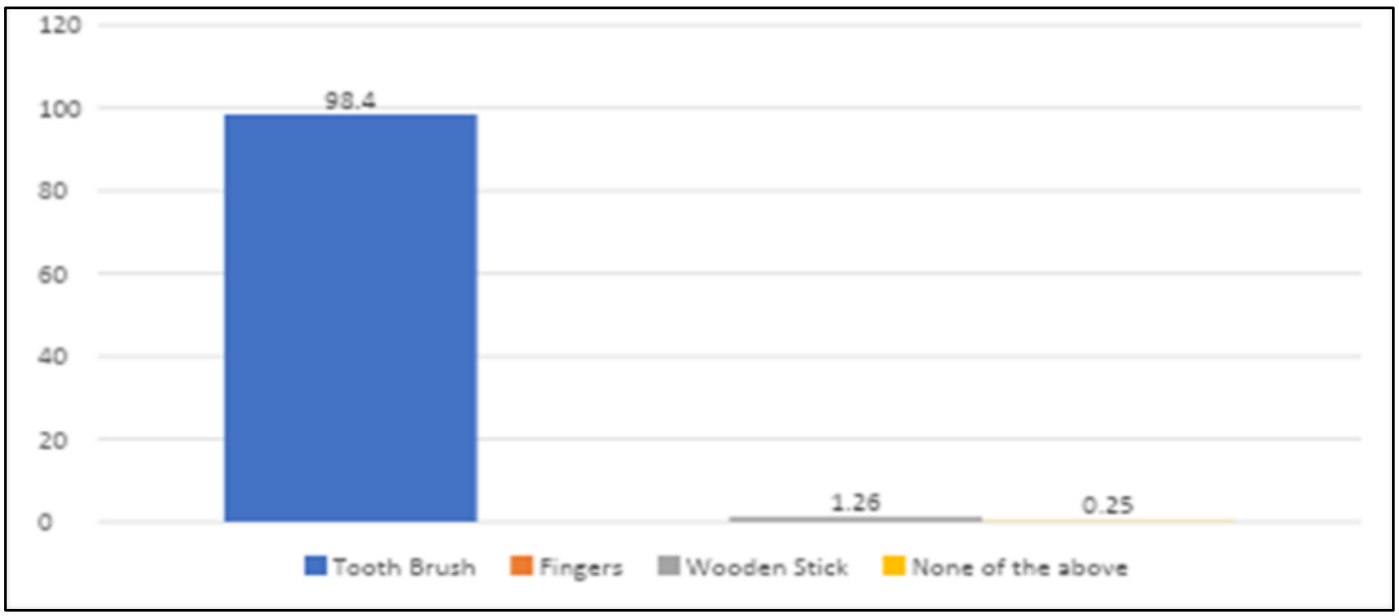


Graph 11 Referral to the Dentist by Physician Among Study Population in Percentage



Graph 12 Brushing Frequency Among Study Population in Percentage



Graph 13 Mode of Oral Hygiene Followed Among Study Population in Percentage

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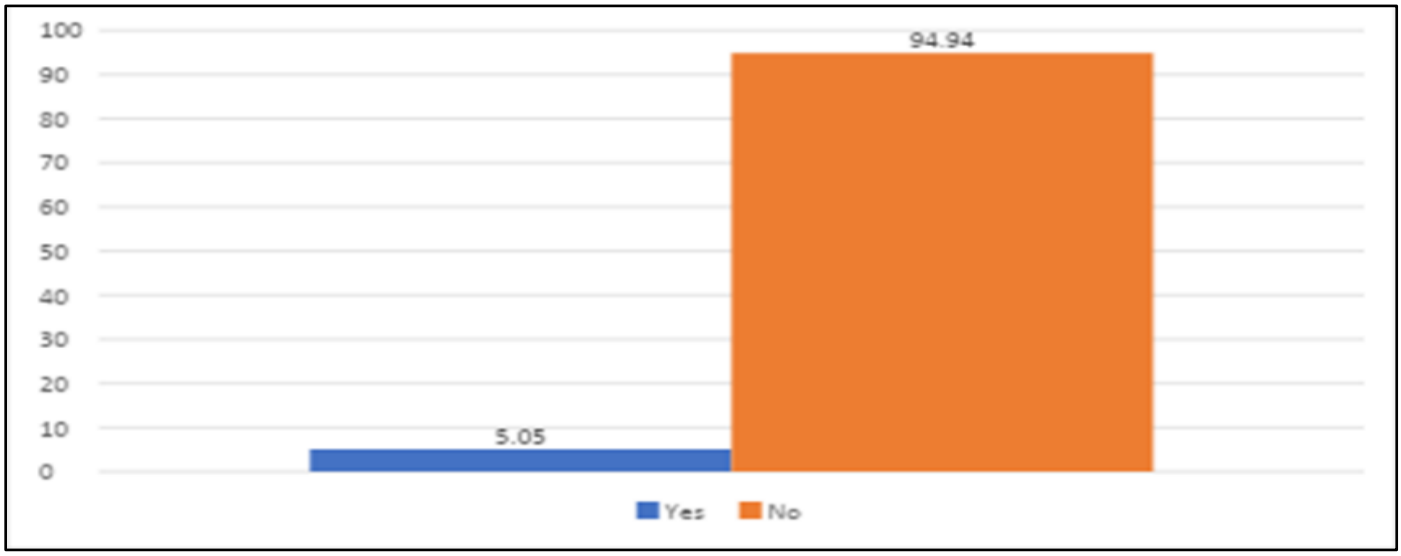
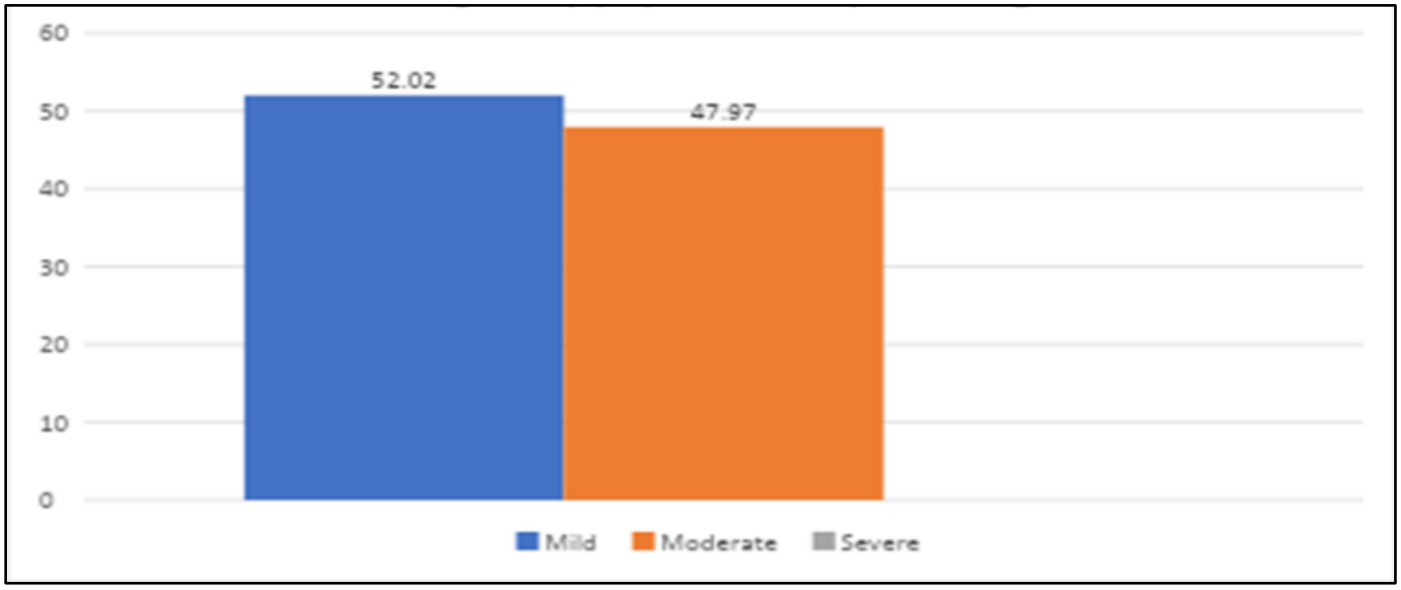
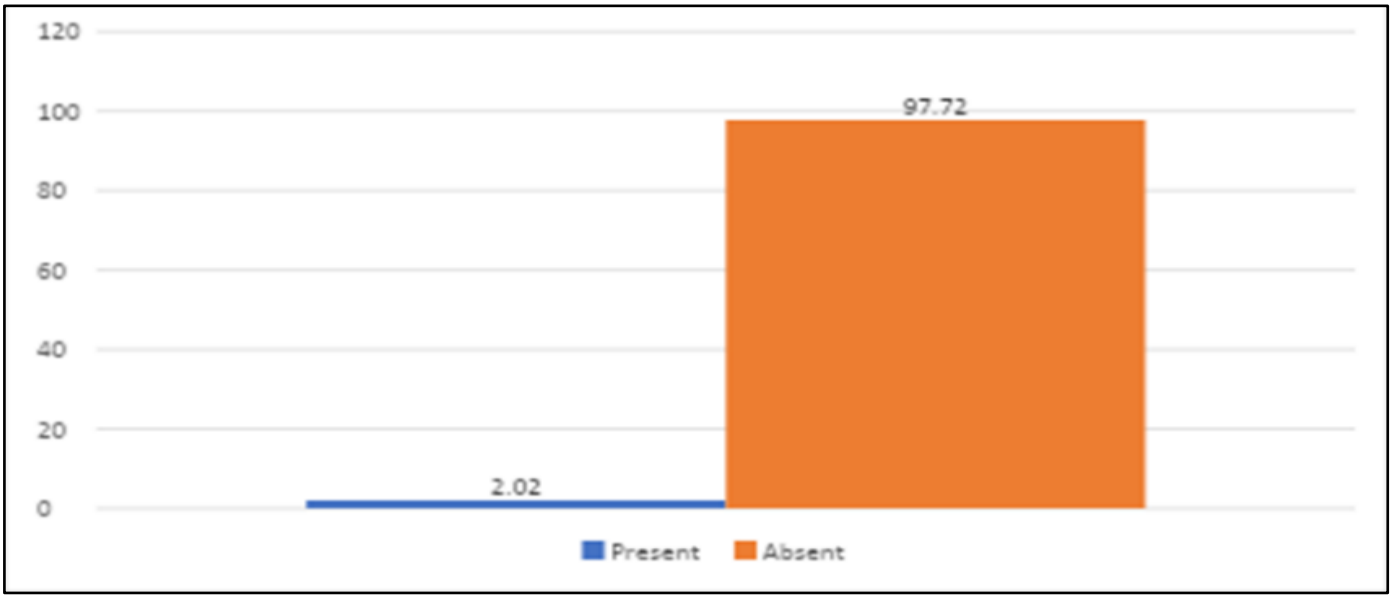


Graph 14 Use of Inter Dental Cleaning Aids Among Study Population in Percentage



Graph 15 Assessment of Gingival Bleeding Index Score Among Study Population in Percentage



Graph 16 Assessment of Presence/Absence of Abscess on Oral Examination Among Study Population in Percentage

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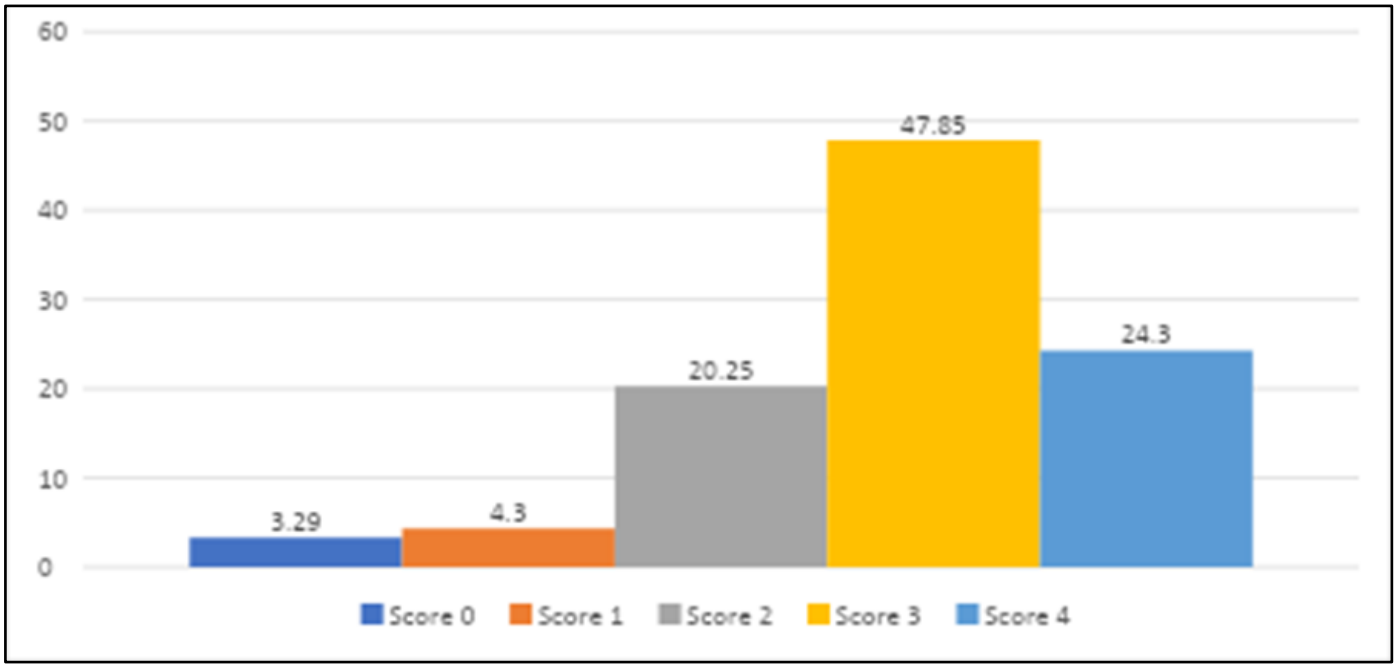
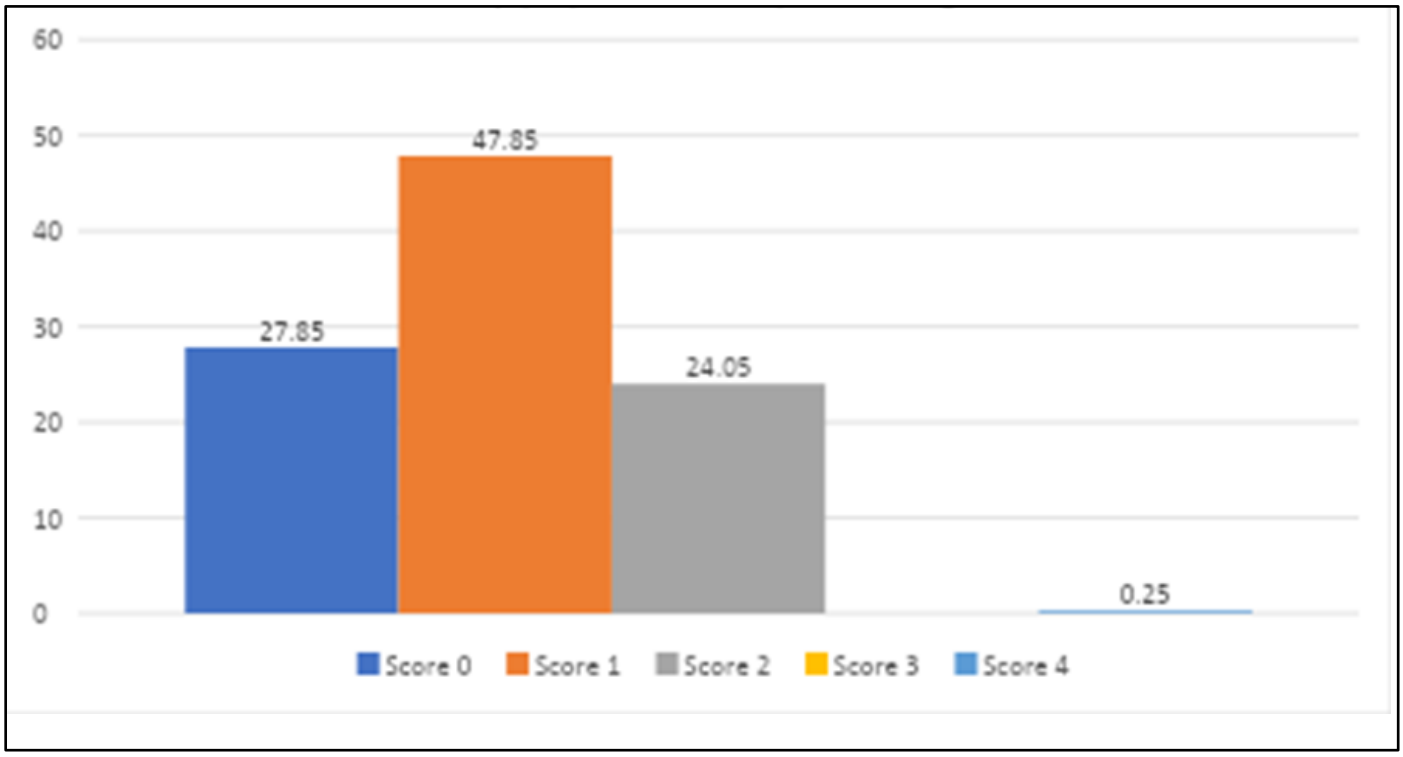


Graph 17 Assessment of Community Periodontal Inder Score Among Study Population in Percentage



Graph 18 Assessment of Loss of Attachment Scores Among Study Population in Percentage

IV. DISCUSSION

A cross-sectional study at the Department of Periodontics, A J Institute of Dental Sciences, Mangalore, evaluated awareness, practice, and periodontal health among 396 type 2 diabetes mellitus (T2DM) patients, with a mean age of 59 years. Of these, 67.67% were men and 32.32% women, with men more likely to have diabetes. Most participants were literate, with 39.90% having attended school and 47.98% being graduates.

Oral health significantly influences systemic health. Research increasingly supports a strong biological link between dental and systemic conditions. Diabetes mellitus, the ninth leading cause of death globally, is a metabolic disorder that can severely affect multiple organs, including the oral cavity. It is projected to affect 592 million people by 2035. Oral complications in diabetics include xerostomia, caries, gingivitis, periodontitis, candidiasis, altered taste, and impaired healing. Periodontitis is the most common dental issue, and its management can aid glycemic control.

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The study revealed poor awareness among participants regarding the link between diabetes and periodontal health. Most visited dentists only when necessary, mainly due to pain, and did not perceive regular dental check-ups as essential. Few discussed diabetes with their dentists, and physicians rarely referred them to dental care. These findings align with Kamath et al., who reported similar unawareness, poor interdental hygiene practices, and infrequent brushing. Clinical examinations showed mild to moderate gingivitis, calculus, periodontal abscesses, probing depths of 4–6 mm, and attachment loss of 4–8 mm, indicating poor periodontal health. Poudel et al. reported that time constraints and lack of knowledge deter diabetes care providers from addressing oral health. Similarly, despite access to subsidized care, many diabetics in Sweden and Australia avoided dental visits unless necessary.

Rol et al. found that 53% of diabetics were unaware of their higher risk for periodontitis, and only 38% believed managing it could aid diabetes control. Allen et al. reported that under half of those visiting the dentist annually knew their risk, and Sandberg et al. found that 48% of patients felt their dentist didn't know about or address their diabetes. In contrast, Jansson et al. (2006) found that 66% of diabetics with periodontal disease acknowledged a connection.

Although most brushed daily with a toothbrush, interdental aids were rarely used, reflecting poor awareness of interproximal hygiene. Educating this high-risk group on such practices is essential for better periodontal outcomes. Studies show that many healthcare professionals recognize the oral-systemic link but do not consistently refer patients to dentists. This gap in both knowledge and practice was also seen in the current study.

Nelson et al. found a higher prevalence of periodontal disease in T2DM patients, while Altamash et al. reported a 0.4% drop in HbA1c following non-surgical periodontal therapy. A 1% HbA1c reduction correlates with a 37% decrease in microvascular complications and 21% fewer diabetes-related deaths.

This study highlights that healthier lifestyle choices, good glycemic control, frequent glucose monitoring, and regular dental visits positively correlate with awareness of the diabetes-periodontal link. Those using interdental aids were also more informed. Better education and communication from healthcare providers are crucial in promoting oral care among diabetics, who are 2–3 times more likely to develop periodontitis. Addressing this knowledge gap is essential for improved overall health outcomes in T2DM patients.

V. CONCLUSION

The study confirms that diabetes is a significant risk factor for poor oral health, with diabetic patients being 2–3 times more likely to develop periodontitis. It is essential for diabetic individuals to understand this link to maintain proper oral hygiene and reduce complications. Healthcare providers, including dentists, should encourage regular dental check-ups and educate patients on the impact of diabetes on oral health to promote better oral care practices.

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