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ORIGINAL ARTICLE

Interplay between diabetes mellitus and salivary gland changes with their clinical implications.

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ABSTRACT… Objective: Evaluate Clinical Implications of Diabetes Mellitus. Find out the correlation between salivary changes with oral changes. **Study Design:** Cross-sectional study. **Setting:** Dental OPDs of BU and JSMU. **Period:** January 2023 to January 2024. **Methods:** with sample size of 44 collected through convenience sampling. Data was collected of patients fulfilling the inclusion criteria of diagnosed and under treatment for Diabetes Mellitus, through a performa specially designed for collection of data of the study. **Results:** Data of 44 patients was included in the study. Out of 44, 8 patients reported with Sialorrhea, 32 with hyposalivation and 4 without any problems. The mean DMFT score was 4.27±0.87. The most common complaint was that of altered taste reported by 4 patients. Correlation test was performed and resulted in showing positive correlation of hyposalivation with dry mouth and altered taste at the level of 0.001 while negative correlation was observed between hypersalivation and dry mouth at the level of 0.05. **Conclusion:** The results are suggestive of constant monitoring of known cases by dentists every 6 months to help them maintain their oral health and improve their quality of life.

Key words: Diabetes Mellitus, Oral Hygiene, Periodontal Diseases, Salivary Glands, Xerostomia.

INTRODUCTION

Diabetes Mellitus is metabolic disease prevalent in low-middle income countries.[1] In Pakistan, Sindh province has reported the highest number of cases as per HBA1C with overall 14.62%(n=49,418) people suffering across the country in 2019 which has increased to 26.7% making 33 million reported in 2022 with an estimate of 9 million undiagnosed cases.[2,3] In addition, there is an increase in patients coming with complications including cardiovascular conditions, neuropathies and ocular conditions due to uncontrolled sugar levels.[1] As a direct result oral health is also affected by it as it decreases the immune response of individuals and provide grounds for breeding of infections due to increased sugar levels. The commonly reported oral conditions in diabetic patients are gingivitis, periodontitis, oral lichen planus, candidiasis, altered taste, salivary gland dysfunction, glossodynia and stomatopyrosis.[4]

Recently a systematic review on the effects of DM on oral health quality of life was published in 2023 quoting that the oral health related quality of life is not affected by DM but can lead to functional imitation, physical pain, and psychological discomfort. Al though, the consequences are xerostomia and periodontal diseases.[5] While a study conducted in Brazil reported 78.4% presence of oral lesions with the highest prevalence of traumatic ulcers (16.4%) followed by actinic cheilitis (12.7%) with the lips (35.3%) and tongue (23.5%) were the most common location.[6] Another study held in Chennai showed that majority of the patients reported with xerostomia and periodontal pathologies. However, contrary to previous studies, no significant differences were found in the prevalence of traumatic ulcer, fissured tongue, lichen planus, and parotid enlargement.[7] A study conducted in Kerala explored the presence of oral premalignant lesions in 927 patients and found that there is no significant relationship between the two variables in men while in women a significant correlation

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was reported but the underlying pathogenesis was unknown.[8] All these confirm the findings that most prevalent problems are xerostomia which affects the pH of the environment and results in other oral diseases.

A recent study conducted in Pakistan among diabetic patients aimed to explore the connection between poor oral hygiene and diabetes. The study revealed that while diabetic patients had sufficient knowledge about oral hygiene measures, their attitudes and practices fell short. This suggests that local dentists and dental regulatory bodies have effectively raised awareness about oral health through community outreach programs and advertising campaigns. However, there is a scarcity of data from Pakistan in the published literature on this topic. Therefore, the study's objective is to examine the correlation between salivary gland changes in diabetic individuals and various oral health issues among residents of Karachi, the cosmopolitan capital of Sindh with the largest population and a high number of reported cases of diabetes.

METHODS

A cross-sectional study was conducted at BU and JU during the period of January 2023 to January 2024 after getting permission from IRB board of BU (Ref No. BDC/ERB/2022/01) (22-11-22). Data of patients visiting dental clinics in these institutes was collected. The sample size was calculated to be 44 according to the number of cases reported in Sindh as 49,418 at 50% anticipated frequency at 95% confidence interval through OpenEpi Software version 3.01.[2,9] Inclusion criteria was diagnosed or known cases of type 2 Diabetes either on oral hypoglycemics or on insulin were included while prediabetics were excluded. Convenience sampling was done.

Data of patients coming to Dental OPD was collected on a performa specially designed for this study. Information regarding their decayed, missing, filled permanent teeth (DMFT index) status and any changes or pathologies diagnosed by the clinician were included after studying past literature. The mucosal/ salivary gland changes studied were dry mouth/hyposalivation, burning mouth syndrome, gingivitis, altered taste and sialorrhea.[6,7] The validity and reliability of the data collection tool was found to have good face validity with Crohnbach`s Alpha of 0.7 on pilot study sample of 10 patients which was not included in the final study data. Performa with incomplete information were excluded from the study sample.

RESULTS

A total of 44 diabetic patients were included in the study which comprises of 24 females and 20 males aged between 50-65 years. The mean DMFT mean score was 4.27±0.87 with minimum score of 3 and maximum score of 6. The most predominant problem quoted by them was hyposalivation (n=32) followed by sialorrhea (n=8) with only 4 patients without any abnormality (Table-I). While Table-II shows the breakdown of oral problems reported and diagnosed by clinician.

S No.	Variable	Frequency(n)
1	Sialorrhea	8 (18%)
2	Hyposalivation	32 (72.7%)
3	No abnormality	4 (9%)

Table-I. Frequency of salivary gland changes in diabetics.

Sr. No	Problems	Frequency (n)	Mean	S/D
1	Dry Mouth	2 (4.54%)	1.9091	.29080
2	Burning Mouth syndrome	2 (4.54%)	1.5682	.50106
3	Altered Taste	4 (9.09%)	2.1591	1.03302
4	Decayed	2 (4.54%)	1.2727	.45051
5	Missing	2 (4.54%)	1.2500	.43802
6	Filled	2 (4.54%)	1.7500	.43802
7	Gingivitis	2 (4.54%)	1.6818	.47116

Table-II. Frequency of oral problems.

Sr. No	Variables	Hypo-salivation	Sialorrhea
1	Dry Mouth	.4966**	-.303*
2	Burning Mouth syndrome	1	.149
3	Altered Taste	.458**	-.184
4	Decayed	.146	-.024
5	Missing	.118	.000
6	Filled	.236	-.272
7	Gingivitis	-.104	-.016

Table-III. Correlation between salivary changes with other oral changes.

*Correlation is significant at the level of 0.05 level.
**Correlation is significant at the level of 0.001 level.

Table-III shows the correlation between salivary changes with DMFT, burning mouth, altered taste and gingivitis. Positive correlation between hyposalivation with dry mouth and altered taste at the level of 0.001 level was found while negative correlation between sialorrhea and dry mouth at the level of 0.05 level.

DISCUSSION

The study explores the effect of diabetes mellitus on oral changes and the underlying most probable cause is salivary gland secretion. Comparing the DMFT score of current study with that published in 2022 conducted in Rawalpindi showed lesser score of 4.27 in comparison to that of 6.9 which is relatively lower and indicator of relatively better oral hygiene to the reports from previous study. They also, observed periodontal pocketing in 43.1% (n=148) of their patients which is a sign of periodontal disease which is very low4.54% (n=44) shown by clinically diagnosed gingivitis in the current sample.[10]

Various other studies have reported presence of benign and malignant oral conditions and lesions in Type 2 Diabetes patients reporting xerostomia, periodontitis and traumatic or aphthous ulcer which is in line with our data.[4,7,11,13] Xerostomia and hyposalivation are two distinct diagnosis based on salivary flow evaluation. Both hyposalivation and occasionally sialosis are well documented in literature.[14,15] We found that majority of our patients with hyposalivation (n=32, 72.7%) while few had sialorrhea (n=8, 18%) and limited with no problems (n=4, 9%). The pathophysiology explained behind hyposalivation is salivary gland changes due thirst, dehydration, oral sensory dysfunction all causing altered saliva composition leading to more viscous consistency of saliva which presents itself as dry mouth.[14] The flow rate is inversely affected by hyperglycemia.[16,17] Alteration in taste is another well-established complaint which was the leading problem in our sample population.[14,18] Hypersalivation observed in 9% of the data is a unique finding, and was not reported and backed by previous published literature.[14,18]

On applying correlation test to find out the relationship between hyposalivation and sialorrhea with the oral problems we found positive correlation at the level of 0.001 level between hyposalivation with dry mouth and altered taste while negative correlation at the level of 0.05 level was found between sialorrhea and dry mouth. This is same to previous published data that saliva of diabetic patients were significantly ($p < 0.05$) reduced.[19] In addition to this another study supports present results which was completed in Chennai showing significant association of diabetes mellitus with xerostomia ($P < 0.003$) and chronic periodontitis ($P < 0.026$).[7] Whilst, we found no association of salivary reduction or increase with gingivitis, missing teeth, filled teeth, decayed, and burning mouth syndrome.

The published literature is limited in regard to studies correlating salivary changes with the oral changes including premalignant and benign conditions that may arise from it from the dental perspective.[4,7,11,13,17] The majority of the benign conditions correlates to the defective immunological response, with addition of hyperglycemia providing supportive environment for opportunistic infections to grow. Though any such findings are not part of the current study, past literature supports it.[4,7,11,13,17] The oral infections and other consequences of deranged glycemic levels can be limited by managing the random blood sugar and fasting levels at their optimal recommended range managed by endocrinologists and supported by other healthcare team members.[20] Continuing monitoring by the dentist every 6 months may help limits the repercussions of the decreased or increased salivary flow including periodontal disease and decaying of teeth. Overall, as literature supports oral lesions like oral infections and premalignant and malignant lesions can be managed effectively before their progress to non-treatable size with more complications.[20]

The study design of cross-sectional lacking establishment of the cause-and-effect

relationship, convenience sampling and relatively small sample size limits the generalizability of data to the larger population. Future longitudinal studies with large sample population may fulfil this deficiency making the results more generalizable.

CONCLUSION

The highest number of our patients presented with hyposalivation and altered taste as the chief complaint. Furthermore, correlation between hyposalivation and dry mouth and altered taste was found positive at the level of 0.001 level albeit to negative correlation between sialorrhea and dry mouth found at the level of 0.05.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used ChatGPT in order to select a title more appealing to audience and improve its readability. After using this tool, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Mahmood Haider	Supervisor of Project, Main idea.	
3	Kashif Ikram	Critical review, Proof reading.	
4	Sanaa Ahmed	Critical review, Data analysis, Data collection, Writing.	
5	Zubair Ahmed Abbasi	Critical review, Data analysis, Data collection, Writing.	
6	Aqib Rana	Data Analysis, Data collection.	
7	Muhammad Khalil	Critical review.