Evaluating the anti-microbial efficacy or various diabetic toothpastes on common Perio pathogens

Dr. Himabindu. L[1], Dr. Vaishali Sarve[2], Dr. Anupama Gaur[3], Dr. Neha Kumari[4*], Dr. Madhuresh Kumar[5], Dr. Pooja Yadav[6]

[1]MDS [Periodontics & Implantology], Associate Professor, Department of Dentistry, Neelima Institute of Medical Sciences, Anurag University, Ghatkesar, Hyderabad, Telangana

[2] Dental Surgeon, Department of Orthodontics, Government Dental College and Hospital, Nagpur, Maharashtra

[3]MDS, Professor, Department of Public Health Dentistry, RUHS College of Dental Sciences, Jaipur, Rajasthan

[4*]MDS, Senior Lecturer, Department of Periodontology & Implantology, Vananchal Dental College & Hospital, Garhwa, Jharkhand

[5]Professor, Department of Oral Pathology & Microbiology, Buddha Institute of Dental Sciences & Hospital, Patna, Bihar

[6]Junior Resident, Department of Periodontogy, Faculty of Dental Sciences at the Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh

Corresponding author

Dr. **Neha Kumari**

Senior Lecturer, Department of Periodontology & Implantology, Vananchal Dental College & Hospital, Garhwa, Jharkhand

Email id: drnehakumarigarhwa@gmail.com

Abstract

Background: Uncontrolled or poorly controlled diabetes mellitus is a chronic metabolic disease that affects various organ systems and organs. Poor oral hygiene can lead to periodontitis and impairment of blood sugar control. It is crucial to assess antimicrobial efficacy of various anti-diabetic toothpastes on common periodontal pathogens.

Aim: The present study was aimed to evaluate the anti-microbial efficacy or various diabetic toothpastes on common Perio pathogens.

Methods: The present study assessed 3 toothpastes namely Colgate toothpaste, Colgate toothpaste for the oral health of diabetics, and Apollo Pharmacy Diabetic Sugar-Free Toothpaste were tested against Aggregatibacter actinomycetemcomitans and Porphyromonas gingivalis common pathogens of periodontal disease. Agar diffusion method and Blood agar culture media were used to measure inhibition zone and MIC (minimum inhibitory concentration) was measured with McFarland turbidity to test antimicrobial activity of two anaerobic microbes.

Results: The study results showed that in 3 toothpastes, highest zone of inhibition against P gingivalis was seen in Apollo Pharmacy Diabetic Sugar-Free Toothpaste with 21.2±1.39 with p-value of 0.007. MIC (Minimum inhibitory concentration) of apollo pharmacy diabetic sugar free toothpaste was 0.6 µL/mL for Aggregatibacter actinomycetemcomitans which was lesser compared to 6.23 µL/mL for P. Gingivalis. For both the bacteria, MIC for Colgate toothpaste for the oral health of diabetics was 6.23 µL/mL.

Conclusion: The present study concludes that Apollo Pharmacy Diabetic Sugar-Free Toothpaste is an efficacious toothpaste for diabetics which has high efficacy against the causative perio pathogens including P Gingivalis and Aggregatibacter actinomycetemcomitans.

Keywords: Anaerobic microbes, antimicrobial efficacy, diabetic toothpaste, Diabetic Sugar-Free Toothpaste

How to cite this article: Himabindu L, Sarve V, Gaur A, Kumari N, Kumar M, Yadav P. Evaluating the anti-microbial efficacy or various diabetic toothpastes on common Perio pathogens. Int J Drug Deliv Technol. 2026;16(71s): 1180-1184. DOI: 10.25258/ijddt.16.71s.138

Introduction

Primary biofilm such as calculus and plaque are the local factors included in the etiology of periodontal disease. Periodontal health include tooth supporting and periodontal structures. Various measures including gingival massage, flossing, and toothbrushing with dentifrices are recommended to remove the local risk factors to promote the periodontal health and prevent the occurrence of periodontitis. Oral microbes linked to periodontitis are primarily anaerobes as Aggregatibacter actinomycetemcomitans, Neisseria spp., Eikenella corrodens, Capnocytophaga spp., Prevotella intermedia, and Porphyromonas gingivalis. Other than local risk factors, systemic health also has a crucial role in maintaining proper periodontal health. Periodontal systemic link has been extensively assessed in literature with research being still continued.[1]

India being the diabetes mellitus capital across the globe with a high prevalence of periodontal disease with an existing relation in poor oral health and metabolic disease. Also, there are various long-term complications of diabetes mellitus as neuropathy, diabetic macroangiopathy, and diabetic microangiopathy. Majority of the studies have reported a high severity and prevalence of periodontal disease in diabetics than nondiabetics with similar local risk factors leading to tooth loss, increased tooth mobility, bleeding on probing, and bone loss. It has been documented that diabetes mellitus can independently increase the periodontal disease risk. Hence, periodontitis is considered as 6th complication of diabetes mellitus. Proper oral hygiene measures help in maintaining adequate blood sugar levels and prevent periodontitis.[2]

Oral hygiene measures mainly include dental floss, toothpaste, and tooth brush where toothbrush helps in maintaining plaque free tooth surface and dentifrice works as a vehicle and lubricant for delivering the mechanical agents as antimicrobial agents, triclosan, and fluorides. Various oral health products are recommended for oral health improvement and for specific conditions including diabetic toothpaste to inhibit the growth, and multiplication of periodontal pathogen, desensitizing toothpaste against tooth sensitivity, and fluoridated toothpaste to fight against tooth decay. Conventional toothpastes help in improving oral hygiene and literature report that diabetics are at high risk of developing periodontitis necessitating using specific toothpaste for diabetics.[3]

Various manufacturers report an indirect and direct antimicrobial efficacy of diabetic toothpastes on periodontal pathogens. Diabetics can get confused for selection of ideal toothpaste for diabetics to prevent the 6th complication. Various studies have assessed the antimicrobial effect of conventional toothpastes and few on diabetic toothpastes. However, existing literature data is still scarce in this context.[4] Hence, the present study was aimed to evaluate the anti-microbial efficacy or various diabetic toothpastes on common Perio pathogens.

Materials and methods

The present in-vitro study was aimed to evaluate the anti-microbial efficacy or various diabetic toothpastes on common Perio pathogens. The study subjects were from Department of Dentistry, Neelima Institute of Medical Sciences, Anurag University, Ghatkesar, Hyderabad, Telangana in the period from August 2025 to April 2026. Verbal and written informed consent were taken from all the subjects before study participation.

The study utilized Colgate toothpaste as control assessed against two randomly selected diabetic toothpastes namely Apollo Pharmacy Diabetic Sugar-Free Toothpaste and Colgate toothpaste for the oral health of diabetics. The antimicrobial efficacy was assessed against P. gingivalis and A. actinomycetemcomitans. The study duration was 20 days.

For selection of microorganisms, clinical isolates of P. gingivalis and A. actinomycetemcomitans were taken from cultural plates of microorganisms preserved on blood agar slants preserved at Institutional laboratory. Antimicrobial activity was assessed using cultural media which was Sterile Blood agar for Agar diffusion method and antimicrobial activity was assessed by MIC (minimum inhibitory concentration). Controls for MIC were broth compound (broth + compound) and growth control (broth + organism).

Agar diffusion test was used to assess organisms' susceptibility to diabetic toothpastes. Sterile blood agar plates were used as culture media and were taken to room temperature before the use. Antimicrobial efficacy of diabetic toothpastes was assessed with Disk agar diffusion technique of Bauer et al.[5] Inoculum was prepared using a swab or loop, the colonies were transferred to the plate and turbidity was visually adjusted using broth similar to that of a 0.5 McFarland turbidity standard that has been vortexed.[6] As an alternate, the suspension was standardized with a photometric device.

Agar plates were inoculated within 15 minutes of inoculum adjusting to McFarland 0.5 turbidity standard, a sterile cotton swab was dipped into the inoculum and rotated it against the wall of the tube above the liquid to remove excess inoculum. The entire surface of agar plate was swabbed three times, rotating the plates approximately at 60° between streaking to ensure even distribution. Aerosol creation was avoided and stock solution was

prepared by measuring 10mg compound and dissolving it in 1ml of dimethyl sulfoxide.

Adding compound to agar plate was done regularly and incubated within 15 minutes of compound application. The plates were then inverted and incubated for 18-24 hours at 37 degrees Celsius. Plates were then read only if the lawn of growth was confluent or nearly confluent, and the diameter of inhibition zone was measured to the nearest whole millimeter by caliper measuring device. For Facultative anaerobes, incubate plates in the CO2 Jar and keep the jar in the incubator at 37 °C. And for Anaerobic organisms, Incubate the plates in the Anaerobic Jar and keep the jar in the Incubator at 37°C.

The collected data were statistically analyzed with SPSS software version 23.0 (IBM Corp., Armonk, NY, USA). Shapiro-Wilk test was used to assess the normality of the data. Student t-test and chi-square test were used in the study. The data was expressed as mean and standard deviation and frequency and percentage. The p-value of <0.05 was considered as statistically significant.

Results

The present in-vitro study was aimed to evaluate the anti-microbial efficacy or various diabetic toothpastes on common Perio pathogens. The present study assessed 3 toothpastes namely Colgate toothpaste, Colgate toothpaste for the oral health of diabetics, and Apollo Pharmacy Diabetic Sugar-Free Toothpaste were tested against Aggregatibacter actinomycetemcomitans and Porphyromonas gingivalis common pathogens of periodontal disease. Agar diffusion method and Blood agar culture media were used to measure inhibition zone and MIC (minimum inhibitory concentration) was measured with McFarland turbidity to test antimicrobial activity of two anaerobic microbes. It was seen that for all the tested toothpastes, there were different zones of inhibition and all the toothpastes had sensitivity for P. Gingivalis and were resistant towards A. actinomycetemcomitans (Table 1).

The study results showed that Apollo Pharmacy Diabetic Sugar-Free Toothpaste depicted the highest zone of inhibition against P. Gingivalis with 21.2±1.39 in comparison to Colgate toothpaste for the oral health of diabetics with mean zone of inhibition being 16.3±0.69 and Colgate toothpaste with mean zone of inhibition being 12.3±0l.69 depicting a statistically significant difference with p=0.007 (table 2).

It was also seen that concerning the three toothpastes assessed in the study, Colgate toothpaste for the oral health of diabetics and Apollo Pharmacy sugar-free diabetic toothpaste and showed MIC at 6.23 µL/mL and plain Colgate toothpaste at 23 µL/mL against P. gingivalis (Table 3).

The study results also showed that Apollo Pharmacy sugar-free diabetic toothpaste showed MIC of 0.6 µL/mL against A. actinomycetemcomitans, whereas, plain Colgate toothpaste and Colgate toothpaste for the oral health of diabetics shows inhibition at the same concentration that is 6.23 µL/mL against A. actinomycetemcomitans (Table 3).

Discussion

The present study assessed 3 toothpastes namely Colgate toothpaste, Colgate toothpaste for the oral health of diabetics, and Apollo Pharmacy Diabetic Sugar-Free Toothpaste were tested against Aggregatibacter actinomycetemcomitans and Porphyromonas gingivalis common pathogens of periodontal disease. Agar diffusion method and Blood agar culture media were used to measure inhibition zone and MIC (minimum inhibitory concentration) was measured with McFarland turbidity to test antimicrobial activity of two anaerobic microbes. It was seen that for all the tested toothpastes, there were different zones of inhibition and all the toothpastes had sensitivity for P. Gingivalis and were resistant towards A. actinomycetemcomitans. These results correlated with the findings of Warkad PG et al[7] in 2025 and Andrade-Ochoa S et al[8] in 2021 where results similar to the present study were also reported by the authors in their studies.

It was seen that Apollo Pharmacy Diabetic Sugar-Free Toothpaste depicted the highest zone of inhibition against P. Gingivalis with 21.2±1.39 in comparison to Colgate toothpaste for the oral health of diabetics with mean zone of inhibition being 16.3±0.69 and Colgate toothpaste with mean zone of inhibition being 12.3±0l.69 depicting a statistically significant difference with p=0.007. These findings were in line with the results of Jensen AB et al[9] in 2020 and Murugaiyan V et al[10] in 2024 where results for zone of inhibition reported by authors were similar to the results of the present study.

The study results showed that concerning the three toothpastes assessed in the study, Colgate toothpaste for the oral health of diabetics and Apollo Pharmacy sugar-free diabetic toothpaste and showed MIC at 6.23 µL/mL and plain Colgate toothpaste at 23 µL/mL against P. gingivalis. These results were consistent with the findings of Limeback H et al[11] in 2023 and Kengadaran S et al[12] in 2022 where results for MIC similar to the present study were also reported by the authors in their studies.

It was also seen that Apollo Pharmacy sugar-free diabetic toothpaste showed MIC of 0.6 µL/mL against A. actinomycetemcomitans, whereas, plain

Colgate toothpaste and Colgate toothpaste for the oral health of diabetics shows inhibition at the same concentration that is 6.23 µL/mL against A. actinomycetemcomitans. These findings were in agreement with the results of Othman MA et al[13] in 2021 and Griauzdyte V et al[14] in 2023 where results for MIC reported by the authors were comparable to the results of the present study.

Conclusion

Within its limitations, the present study concludes that Apollo Pharmacy Diabetic Sugar-Free Toothpaste is an efficacious toothpaste for diabetics which has high efficacy against the causative perio pathogens including P Gingivalis and Aggregatibacter actinomycetemcomitans.

References

1. Casanova L, Hughes FJ, Preshaw PM. Diabetes and periodontal disease: A two-way relationship. Br Dent J 2014;217:433-7.
2. Bharti V, Khurana P. Metabolic syndrome and periodontal disease. J Indian Soc Periodontol 2009;13:172-4.
3. Pandey SK, Sharma V. World diabetes day 2018: Battling the emerging epidemic of diabetic retinopathy. Indian J Ophthalmol 2018;66:1652-3.
4. Alwaeli AZ. Anaerobic bacteria associated with periodontitis. In: Oral Microbiology in Periodontitis. Rijeka: InTech; 2018.
5. Bauer AW, Kirby WM, Sherris JC, Turck M. Antibiotic susceptibility testing by a standardized single disk method. Am J Clin Pathol 1966;45:493-6.
6. Lonsway DR, Preparation of routine media and reagents used in anitimicrobial susceptibility testing. In : Leber AL, editor. Clinical Microbiology Procedures Handbook. Section 7: Antimicrobial Susceptibility Testing: 2023.
7. Warkad PG, Nagappa KG, Waral C, Sudheer KH, Gawali P, Jaychandra MG, et al. Antimicrobial efficacy of different diabetic toothpastes on anaerobic periodontal pathogens: An in vitro experimental study. J Indian Assoc Public Health Dent 2025;23:91-6.
8. Andrade-Ochoa S, Chacón-Vargas KF, Sánchez-Torres LE, Rivera-Chavira BE, Nogueda-Torres B, Nevárez-Moorillón GV. Differential antimicrobial effect of essential oils and their main components: Insights based on the cell membrane and external structure. Membranes (Basel) 2021;11:405.
9. Jensen AB, Isidor F, Lund M, Væth M, JohanssonA, Lauritsen NN, et al. Prevalence of Aggregatibacter actinomycetemcomitans and periodontal findings among 14 to 15-year old Danish adolescents: A descriptive cross-sectional study. Pathogens 2020;9:1054.
10. Murugaiyan V, Utreja S, Hovey KM, Sun Y, LaMonte MJ, Wactawski-Wende J, et al. Defining Porphyromonas gingivalis strains associated with periodontal disease. Sci Rep 2024;14:6222.
11. Limeback H, Enax J, Meyer F. Improving oral health with fluoride-free calcium-phosphate-based biomimetic toothpastes: An update of the clinical evidence. Biomimetics (Basel) 2023;8:331.
12. Kengadaran S, Anusha D, Baskar K, Muthukrishnan K, Pooraninagalakshmi J, Prabakar J. Comparative effectiveness of herbal and conventional toothpaste on prevention of dental caries: Systematic review and meta-analysis. Indian J Dent Res 2022;33:332-7.
13. Othman MA, Abdurrahman M, Tawfeeq HK, Al-Sadoon TA, Mjbel AM, Katea HA, et al. Study the effect of some tooth paste on the oral health. Journal of Biotechnology Research Center December 2021;15:104-10.
14. Griauzdyte V, Jagelaviciene E. Antimicrobial activity of zinc against periodontal pathogens: A systematic review of in vitro studies. Medicina (Kaunas) 2023;59:2088.

S. No	Toothpaste	A. Actinomycetemcomitans	P. Gingivalis
	Colgate toothpaste	Resistant	13mmx12 mm
	Colgate toothpaste for oral health of diabetics	Resistant	16mmx17 mm 16mmx17 mm
	Apollo pharmacy Diabetic sugar-free toothpaste	Resistant	20mmx22 mm 20mmx17 mm

Table 1: Agar diffusion test results in study subjects

S. No	Toothpaste	Mean	p-value
	Colgate toothpaste	12.3±0.69	**0.007**
	Colgate toothpaste for oral health of diabetics	16.3±0.69	
	Apollo pharmacy Diabetic sugar-free toothpaste	21.2±1.43	

Table 2: Comparison of zone of inhibition in P. Gingivalis

S. No	Toothpaste	P. Gingivalis	A. Actinomycetemcomitans
	Colgate toothpaste	23	6.23
	Colgate toothpaste for oral health of diabetics	6.23	6.23
	Apollo pharmacy Diabetic sugar-free toothpaste	6.23	0.6

Table 3: Assessing the MIC (minimum inhibitory concentration)