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Efficacy of probiotic therapy as an adjunct to non-surgical periodontal therapy: A randomized controlled trial

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Abstract:
Scaling and root planing (SRP) alone may not fully eliminate subgingival pathogens, prompting interest in adjunctive probiotics for periodontitis. Therefore, it is of interest to evaluate adjunctive probiotic therapy in 80 patients with Stage II/III, Grade A/B periodontitis. The test group received SRP with probiotic tablets and mouthwash for 3 months, while controls received SRP alone. The probiotic group showed greater reductions in PI and GI ($p < 0.001$) and greater PPD and CAL improvements ($p < 0.05$). Thus, adjunctive probiotics are a safe and effective addition to non-surgical periodontal therapy.

Keywords: Periodontitis, probiotics, scaling and root planing, non-surgical periodontal therapy, plaque index, gingival index, probing pocket depth, clinical attachment level, oral microbiota and adjunctive therapy.

Background:
Periodontitis is a chronic multifactorial inflammatory disease characterized by progressive destruction of periodontal supporting tissues, resulting in attachment loss, pocket formation, alveolar bone loss and potential tooth loss. It remains one of the most prevalent chronic inflammatory diseases despite advances in preventive dentistry **[1-3].** Scaling and root planing (SRP) is the cornerstone of non-surgical periodontal therapy because it reduces subgingival biofilm and calculus and improves periodontal clinical parameters **[4].** However, residual microorganisms may persist after mechanical debridement, supporting the use of adjunctive therapies **[5]**. Probiotics are live microorganisms that provide health benefits when administered in adequate amounts **[6]**. They may improve periodontal health by inhibiting pathogenic bacteria, competing for adhesion sites and nutrients and modulating host immune-inflammatory responses **[7, 8].** Oral probiotics can be administered through formulations such as lozenges, tablets, powders, mouth rinses, chewing gums and periodontal preparations **[9].** By modifying the oral microbial environment and reducing periodontal pathogen colonization, probiotics may help maintain microbial balance and improve periodontal outcomes **[10].** Therefore, it is of interest to report the changes in plaque index, gingival index, probing pocket depth and clinical attachment level over three months and to determine whether adjunctive probiotic therapy provides superior clinical outcomes compared with SRP alone.

Materials and Methods:

Ethical clearance:
Institutional ethical clearance was obtained from the Institutional Ethics Committee of KVG Dental College and Hospital, Sullia, with the reference number UGSSO3/2025-26. A randomized controlled clinical trial (RCT) was conducted in a parallel-group design to evaluate the effectiveness of probiotic therapy in improving periodontal health outcomes. The study assessed plaque index (PI), gingival index (GI), periodontal pocket depth (PPD), clinical attachment level (CAL) and patient compliance & acceptability at different time points over a 3-month follow-up period.

Study population:

Inclusion criteria:

[1] Males and females aged 25–60 years diagnosed with chronic periodontitis (Stage II or III, Grade A or B).
[2] Presence of at least 20 natural teeth.
[3] Probing pocket depth (PPD) ≥ 4 mm in at least 4 sites per patient.
[4] No periodontal therapy (SRP or surgery) received in the last 6 months.
[5] No recent (past 3 months) use of probiotics, antibiotics, anti-inflammatory drugs, or antiseptic mouthwashes.
[6] Willing to comply with study protocols and follow-ups.

Exclusion criteria:

[1] History of systemic antibiotic or probiotic use in the last 3 months.
[2] Smokers, tobacco chewers, or alcoholics.
[3] Presence of systemic conditions affecting periodontal health (*e.g.,* uncontrolled diabetes, autoimmune diseases, osteoporosis, or immunosuppression).
[4] Pregnant or lactating women.
[5] Allergy to probiotics or mouthwash ingredients.
[6] Patients with orthodontic appliances, removable prostheses, or extensive restorations affecting plaque retention.

Sample size calculation:
The sample size was estimated based on a power analysis, assuming an expected difference of at least 1.0 mm in PPD reduction between the probiotic and control groups, a significance level (α) of 0.05, power ($1-\beta$) of 80% and an effect size of 0.8. A minimum of 40 patients per group (80 totals) were recruited.

Randomization and grouping:
Participants were randomly allocated into two groups using a computer-generated random number table

Test Group (SRP + Probiotics):
Underwent Scaling and Root Planing (SRP); received probiotic tablets containing *Lactobacillus paracasei* (1 tablet/day for 3

months); and used probiotic mouthwash containing *Lactobacillus bulgaricus* (twice daily for 3 months).

Control Group (SRP Alone):
Underwent Scaling and Root Planing (SRP) only, with no probiotic supplementation or mouthwash

Study procedure:
Following approval from the Institutional Ethics Committee and obtaining written informed consent, eligible participants diagnosed with Stage II–III, Grade A or B periodontitis were recruited from the outpatient Department of Periodontology. A comprehensive medical and dental history was recorded. At baseline, clinical periodontal parameters including Plaque Index (PI), Gingival Index (GI), Probing Pocket Depth (PPD) and Clinical Attachment Level (CAL) were recorded by a single calibrated examiner using a William's periodontal probe. All measurements were obtained at six sites per tooth, excluding third molars, to ensure standardization. After baseline assessment, all participants underwent full-mouth scaling and root planing (SRP) under local anesthesia when required. The procedure was performed using both ultrasonic scalers and Gracey curettes until all supra- and subgingival plaque, calculus and contaminated root surfaces were thoroughly removed. Participants were then randomly allocated into two groups using a computer-generated randomization sequence.

Test Group (SRP + Probiotic Therapy):
Participants received SRP followed by adjunctive probiotic therapy consisting of probiotic tablets (one tablet once daily) and probiotic mouthwash (10–15 mL twice daily after tooth brushing) for a period of 3 months. Participants were instructed to slowly dissolve the probiotic tablet in the oral cavity after routine oral hygiene measures and to refrain from eating or drinking for at least 30 minutes after administration. The probiotic mouthwash was used twice daily for approximately 30–60 seconds without subsequent rinsing with water.

Control group (SRP alone):
Participants received only conventional SRP and were instructed to maintain routine oral hygiene practices throughout the study period. No probiotic supplementation was administered. The investigator responsible for recording periodontal parameters remained blinded to group allocation throughout the study to minimize measurement bias. Participants were recalled at 1 month and 3 months following treatment. During each follow-up visit, oral hygiene reinforcement was provided, compliance with the probiotic regimen was assessed in the test group through patient interviews and medication records and any adverse events were documented. Clinical periodontal parameters (PI, GI, PPD and CAL) were reassessed using the same examination protocol employed at baseline. All collected data were entered into a standardized data collection sheet and subjected to statistical analysis using SPSS software. Descriptive statistics were calculated and intergroup and intragroup comparisons were performed using appropriate parametric or non-parametric tests based on data distribution. A p-value of < 0.05 was considered statistically significant.

Statistical analysis:
Data were analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Results were expressed as mean ± standard deviation (SD). Intragroup comparisons of PI, GI, PPD and CAL at baseline, 1 month and 3 months were performed using repeated measures ANOVA, while independent samples t-test was used for intergroup comparisons. VAS scores for taste, ease of use and tolerability were analyzed using descriptive statistics (frequency and percentage). A p-value < 0.05 was considered statistically significant.

Results:
Table 1 show the mean scores of four periodontal parameters-Plaque Index (PI), Gingival Index (GI), Probing Pocket Depth (PPD) and Clinical Attachment Level (CAL)-measured at baseline, one month and three months after scaling and root planing (SRP) in Group 1. For all parameters, the highest mean score was observed at baseline, followed by a progressive reduction at one month and further reduction at three months, indicating continuous clinical improvement over time. The Plaque Index decreased from 2.11 (baseline) to 2.01 (1 month) and 1.92 (3 months), showing improved oral hygiene status. The Gingival Index reduced from 2.10 to 2.00 and 1.90, indicating reduction in gingival inflammation. Probing Pocket Depth showed a marked reduction from 7.57 to 6.92 and 6.27, reflecting significant periodontal pocket reduction. Clinical Attachment Level decreased from 8.57 to 7.92 and 7.27, indicating gain in clinical attachment. Among all parameters, PPD and CAL demonstrated the greatest magnitude of improvement. All changes were highly statistically significant ($p < 0.001$). **Table 2** show the mean scores of periodontal parameters at baseline, one month and three months following SRP combined with probiotics in Group 2. For all parameters, the highest mean values were recorded at baseline, followed by a substantial reduction at one month and a further marked reduction at three months, indicating continuous and enhanced periodontal improvement. Plaque Index decreased from 2.11 to 1.65 and 1.25; Gingival Index reduced from 2.10 to 1.63 and 1.23; Probing Pocket Depth decreased from 7.57 to 6.30 and 5.45; and Clinical Attachment Level improved from 8.57 to 7.30 and 6.45. Among all parameters, Plaque Index and Gingival Index showed the greatest relative reduction, suggesting a strong adjunctive effect of probiotics on plaque control and gingival health. All observed changes were statistically significant ($p < 0.001$ for most parameters; $p < 0.006$ for PPD). **Table 3** presents the comparison of mean Plaque Index (PI) scores between Group 1 (G1) and Group 2 (G2). At baseline, both groups exhibited nearly identical mean PI scores (G1: 2.11; G2: 2.11), indicating no statistically significant difference ($p = 0.923$). At one month, G1 showed a marked reduction in PI (1.65), whereas G2 demonstrated a relatively higher mean score (2.02); this difference was highly significant ($p < 0.001$). At three months, G1 exhibited a further reduction (1.25) while G2 showed a lesser decrease (1.92) and the

difference remained highly significant ($p < 0.001$). Overall, both groups showed a continuous reduction in plaque levels over time; however, the reduction was more pronounced and consistent in G1 compared to G2. **Table 4** presents the comparison of mean Gingival Index (GI) scores between Group 1 (G1) and Group 2 (G2). At baseline, both groups showed identical mean GI scores (G1: 2.10; G2: 2.10), with no statistically significant difference ($p = 1.000$). At one month, G1 demonstrated a noticeable reduction in GI (1.63), whereas G2 showed a relatively higher mean score (2.00); this difference was highly significant ($p < 0.001$). At three months, G1 exhibited a further decrease (1.23) while G2 maintained higher values (1.90) and the difference remained highly significant ($p < 0.001$). Overall, the improvement in gingival inflammation was more pronounced and consistent in G1 compared to G2. **Table 5** presents the comparison of mean periodontal pocket depth (PPD) between Group 1 (G1) and Group 2 (G2). At baseline, both groups showed identical mean PPD values (G1: 7.57; G2: 7.57), with no statistically significant difference ($p = 1.000$). At one month, G1 demonstrated a reduction in PPD to 6.30, while G2 showed a higher mean value of 6.92; this difference was statistically significant ($p = 0.020$). At three months, G1 exhibited a further reduction to 5.45, whereas G2 showed a comparatively higher value of 6.27 and the difference remained significant ($p = 0.002$). Overall, the reduction in periodontal pocket depth was more pronounced in G1 compared to G2. **Table 6** presents the comparison of mean Clinical Attachment Level (CAL) between Group 1 (G1) and Group 2 (G2). At baseline, both groups exhibited identical mean CAL values (G1: 8.57; G2: 8.57), with no statistically significant difference ($p = 1.000$). At one month, G1 showed an improvement in CAL to 7.30, whereas G2 demonstrated a higher mean value of 7.92; this difference was statistically significant ($p = 0.020$). At three months, G1 exhibited further improvement to 6.45, while G2 showed a comparatively higher value of 7.27 and the difference remained significant ($p = 0.002$). Overall, the improvement in clinical attachment was more pronounced in G1 compared to G2. **Table 7** present the distribution of VAS scores for taste among participants in Group 2. The majority of participants rated taste as 3 (45%), followed by 4 (40%), indicating that most subjects perceived the taste as acceptable to good. A smaller proportion rated it as 2 (7.5%) and 5 (7.5%), while no participants reported the lowest score. Overall, the taste of the intervention was generally well accepted, with most responses falling within the moderate to high range. **Table 8** present the distribution of VAS scores for ease of use among participants in Group 2. The majority of participants rated ease of use as 4 (45%), followed by 3 (40%), indicating that most subjects found the intervention easy to use. A smaller proportion rated it as 2 (7.5%) and 5 (7.5%), while no participants reported the lowest score. Overall, the intervention was generally user-friendly, with most responses concentrated in the moderate to high range of ease of use. **Table 9** shows the distribution of VAS Scores for tolerability in Group 2.

Table 1: Intra-group comparison of periodontal parameters (plaque index, gingival index, probing pocket depth and clinical attachment level) at baseline, 1 month and 3 months following srp in group 1

SRP		Time Period	Mean	SD	N	F-value	df	p-value
G1	Plaque Index	BASELINE	2.11	0.213	40	222.68	2	<0.001
		ONE MONTH	2.01	0.213	40			
		THREE MONTH	1.92	0.211	40			
G1	Gingival Index	BASELINE	2.1	0.235	40	254.61	2	<0.001
		ONE MONTH	2	0.235	40			
		THREE MONTH	1.9	0.233	40			
G1	Probing Pocket Depth	BASELINE	7.57	1.39	40	275.61	2	<0.001
		ONE MONTH	6.92	1.07	40			
		THREE MONTH	6.27	1.1	40			
G1	Clinical Attachment Level	BASELINE	8.57	1.3	40	212.613	2	<0.001
		ONE MONTH	7.92	1.07	40			
		THREE MONTH	7.27	1.1	40			

Note: SRP – Scaling and Root Planing.

Table 2: Intra-group Comparison of Periodontal Parameters at Baseline, One Month and Three Months Following SRP with Probiotics in Group 2

SRP + Probiotics		Time Point	Mean	SD	N	F-value	df	p-value
G2	Plaque Index	BASELINE	2.11	0.24	40	293.08	2	<0.001
		ONE MONTH	1.65	0.19	40			
		THREE MONTH	1.25	0.19	40			
G2	Gingival Index	BASELINE	2.1	0.23	40	291	2	<0.001
		ONE MONTH	1.63	0.2	40			
		THREE MONTH	1.23	0.2	40			
G2	Probing Pocket Depth	BASELINE	7.57	1.39	40	288.344	2	<0.006
		ONE MONTH	6.3	1.26	40			
		THREE MONTH	5.45	1.15	40			
G2	Clinical Attachment Level	BASELINE	8.57	1.39	40	287.343	2	<0.001
		ONE MONTH	7.3	1.26	40			
		THREE MONTH	6.45	1.15	40			

Note: SRP + Probiotics – Sporlac-DG Oro-Dental Tablets and probiotic mouthwash.

Table 3: Intergroup comparison of mean plaque index (pi) scores between group 1 (g1) and group 2 (g2) at baseline, 1 month and 3 months

Time Point	Group	N	Mean	SD	p-value
Baseline	G1	40	2.1175	0.2135	0.923
	G2	40	2.1125	0.2441	
1 Month	G1	40	1.65	0.19215	<0.001*
	G2	40	2.0175	0.2135	
3 Months	G1	40	1.2575	0.19597	<0.001*
	G2	40	1.92	0.21147	

*Note: *Level of significance ≤ 0.05. G1: SRP – Scaling and Root Planing; G2: SRP + Probiotics – Sporlac-DG Oro-Dental Tablets and probiotic mouthwash.*

Table 4: Intergroup comparison of mean gingival index (gi) scores between group 1 (g1) and group 2 (g2) at baseline, 1 month and 3 months

Time Point	Group	N	Mean	SD	p-value
Baseline	G1	40	2.1025	0.23587	1
	G2	40	2.1025	0.23587	
1 Month	G1	40	1.6325	0.20555	<0.001
	G2	40	2.0025	0.23587	
3 Months	G1	40	1.2325	0.20555	<0.001
	G2	40	1.905	0.2331	

*Note: *Level of significance ≤ 0.05. G1: SRP – Scaling and Root Planing; G2: SRP + Probiotics – Sporlac-DG Oro-Dental Tablets.*

Table 5: Intergroup Comparison of Mean Periodontal Pocket Depth (PPD) between Group 1 (G1) and Group 2 (G2) at Baseline, 1 Month and 3 Months

Time Point	Group	N	Mean	SD	p-value
Baseline	G1	40	7.575	1.3939	1
	G2	40	7.575	1.3939	
1 Month	G1	40	6.3	1.26491	0.02
	G2	40	6.925	1.07148	
3 Months	G1	40	5.45	1.15359	0.002
	G2	40	6.275	1.10911	

*Note: *Level of significance ≤ 0.05. G1: SRP – Scaling and Root Planing; G2: SRP + Probiotics – Sporlac-DG Oro-Dental Tablets.*

Table 6: Intergroup comparison of mean clinical attachment level (cal) between group 1 (g1) and group 2 (g2) at baseline, 1 month and 3 months

Time Point	Group	N	Mean	SD	p-value
Baseline	G1	40	8.575	1.3939	1
	G2	40	8.575	1.3939	
1 Month	G1	40	7.3	1.26491	0.02
	G2	40	7.925	1.07148	
3 Months	G1	40	6.45	1.15359	0.002
	G2	40	7.275	1.10911	

*Note: *Level of significance ≤ 0.05. G1: SRP – Scaling and Root Planing; G2: SRP + Probiotics – Sporlac-DG Oro-Dental Tablets.*

Table 7: Distribution of vas scores for taste in group 2

Taste (Group 2)	Frequency	Percent
VAS Score		
2	3	7.5
3	18	45
4	16	40
5	3	7.5
Total	40	100

Note: G2: SRP + Probiotics – Sporlac-DG Oro-Dental Tablets and probiotic mouthwash.

Table 8: Distribution of vas scores for ease of use in group 2

Ease of Use (Group 2)	Frequency	Percent
VAS Score		
2	3	7.5
3	16	40
4	18	45
5	3	7.5
Total	40	100

Note: G2: SRP + Probiotics – Sporlac-DG Oro-Dental Tablets and probiotic mouthwash.

Table 9: Distribution of VAS Scores for Tolerability in Group 2

Ease of Use (Group 2)	Frequency	Percent
VAS Score		
2	3	7.5
3	16	40
4	18	45
5	3	7.5
Total	40	100

Note: G2: SRP + Probiotics – Sporlac-DG Oro-Dental Tablets and probiotic mouthwash.

Discussion:

The present study evaluated the clinical effectiveness of scaling and root planing (SRP) alone and SRP combined with probiotics on key periodontal parameters, namely Plaque Index (PI), Gingival Index (GI), Probing Pocket Depth (PPD) and Clinical Attachment Level (CAL). The results demonstrated a progressive and statistically significant improvement in all clinical parameters from baseline to one month and further to three months in both groups, confirming the effectiveness of conventional non-surgical periodontal therapy. However, the group receiving adjunctive probiotic therapy exhibited comparatively greater reductions in PI and GI, together with more pronounced improvements in PPD and CAL, suggesting an additional therapeutic benefit of probiotics when used alongside SRP. These findings are consistent with the systematic review by Li *et al.* (2023), which concluded that adjunctive probiotics significantly enhance periodontal treatment outcomes by improving probing depth reduction, clinical attachment gain and inflammatory control compared with SRP alone **[11].** The authors attributed these improvements to modulation of the oral microbiome, suppression of periodontal pathogens and regulation of host immune responses, providing a biological explanation for the superior outcomes observed in the present study. The significant reduction in plaque accumulation and gingival inflammation observed in the probiotic group is also supported by the systematic review and meta-analysis of Mishra *et al.* (2021), which showed that probiotic supplementation following SRP significantly reduced plaque and gingival inflammation while improving overall periodontal health **[12]**. The authors suggested that probiotics competitively inhibit pathogenic microorganisms, interfere with biofilm maturation and restore microbial homeostasis within the oral cavity. These mechanisms likely contributed to the sustained reduction in PI and GI scores observed throughout the three-month follow-up period in the present investigation. The greater improvements in probing pocket depth and clinical attachment level observed among participants receiving probiotics are further supported by the meta-analysis conducted by Ho *et al.* (2020), which reported that adjunctive probiotic therapy produced significant improvements in periodontal clinical, microbiological and immunological outcomes compared with SRP alone **[13]**. The study emphasized that probiotics reduce periodontal pathogen colonization while simultaneously modulating inflammatory cytokines and promoting a favorable environment for periodontal tissue healing. The concept of guided recolonization by beneficial microorganisms may explain the greater clinical attachment gain and pocket depth reduction demonstrated in the present study. Similarly, the present findings are consistent with the review by Inchingolo *et al.* (2025), which described probiotics as a promising adjunctive strategy capable of modifying oral biofilm composition, suppressing pathogenic

bacterial growth and enhancing host immune regulation **[14]**. The review also highlighted the potential advantages of probiotics over conventional antimicrobial agents, including the absence of antibiotic resistance, preservation of the normal oral microbiota and long-term maintenance of periodontal health. These characteristics further support the clinical relevance of probiotics as an adjunct to conventional periodontal therapy. Overall, the findings of the present study are in strong agreement with contemporary evidence, reinforcing the concept that although SRP remains the cornerstone of non-surgical periodontal therapy, adjunctive probiotic administration provides additional clinical benefits. The enhanced reductions in plaque accumulation and gingival inflammation, together with greater improvements in probing pocket depth and clinical attachment level, suggest that probiotics promote periodontal healing through microbial modulation, competitive exclusion of periodontal pathogens and regulation of host inflammatory responses. Collectively, these findings support the incorporation of probiotics as a safe and effective adjunct in the comprehensive management of periodontitis.

Conclusion:

Adjunctive probiotic therapy combined with scaling and root planing resulted in greater improvements in plaque control, gingival health, probing pocket depth and clinical attachment level than scaling and root planing alone over three months. Probiotics were well tolerated and showed potential as a safe and effective adjunct to conventional non-surgical periodontal therapy. Larger randomized controlled trials with longer follow-up are needed to confirm their long-term clinical benefits.

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