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Research Article

PROBIOTICS AND PREBIOTICS FOR ORAL HEALTH: MYTH OR REALITY

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A R T I C L E I N F O

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A B S T R A C T

Background: Periodontal diseasesare chronic bacterial infections leading to gingival inflammation, periodontal tissue destruction and alveolar bone loss. Chronic gingivitis is one of the commonest disease of oral cavity. Nonsurgical therapy remains the cornerstone of periodontal treatment. Maintenance of oral hygiene plays a vital role in suppression of re-colonization of micro-organism. Adjunctive treatment modalities along with mechanical debridement have been clinically used and investigated for their efficacy. Systemic antioxidants in conjunction with mechanical debridement can offer additional effects. Gingival inflammation results in high degree of free radical release culminating in heightened oxidative damage to the tissues which can be mitigated by "antioxidant defense system"

Aim: Effect of oral administration of probiotics and prebiotics in subjects with chronic gingivitis.

Material and Methods: Subjects aged between 20 to 50 years and diagnosed with chronic gingivitis were selected and divided into two groups with 20 subjects in each group. Patients in group A were advised scaling alone while group B patients were advised oral administration of probiotics and prebiotics along with scaling. Clinical parameters such as plaque index (PI), gingival index (GI), oral hygiene index simplified (OHI-S) and bleeding on probing (BOP) were assessed at baseline and 3 weeks post scaling. **Result**: Oral administration of probiotics and prebiotics reduced all the clinical parameters of gingivitis.

Conclusion: The present clinical study confirms the plaque inhibition, anti-inflammatory and antimicrobial effects of probiotics and prebiotics that can be recommended during non-surgical periodontal therapy and the maintenance phase of periodontal treatment.

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INTRODUCTION

The treatment of periodontal diseases has now moved towards an antimicrobial model of disease management. With the threat of widespread antibiotic resistance rendering many antibiotics useless against important diseases, there is an increased necessity not only to minimize antibiotic use and develop novel nonantibiotic‐based treatments, but also to raise the profile of disease prevention. Probiotics are live microorganisms that when administered in adequate amounts confer health benefits on the host[1] and may be a promising area of research in periodontal therapy by preventing the growth of harmful microbiota or by modulating mucosal immunity in the oral cavity.[2] Mechanical removal of supragingival plaque is the most effective tool to prevent gingivitis[3] but most individuals do not adequately control plaque leading to gingivitis. To overcome this hindrance, antimicrobial products in the form of dentifrices or mouthwashes have been tested for their adjunctive efficacy in reducing plaque and gingivitis.

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Among them, chlorhexidine is regarded as a gold standard in dentistry for the prevention of dental plaque. Though very effective, it has certain side effects such as brown discoloration ofteeth, oral mucosal erosion, and bitter taste.[4] As an alternative preventive tool, the use of probiotics has been proposed, however, only a few clinical studies have been so far conducted on the use of probiotics in the prevention of oral diseases. Thus, taking into consideration, all these above facts and claims, this study was carried out to test the potential antiplaque and anti‐inflammatory properties of probiotics.

MATERIALS AND METHODS

A total of 40 systemically healthy subjects visiting the Department of Periodontology, at Subharti Dental College and Hospital, Meerut were recruited for the study.

The inclusion criteria for the study included:

1. Systemically healthy subjects between the age group 20 – 50 years of age
2. Patients with chronic gingivitis.
3. The following subjects were excluded:
4. History of systemic diseases
5. Pregnant, lactating females

6. History of antibiotic therapy in the past 3 months
7. History of oral prophylaxis within 6 months previous to the study
8. Subjects with mouth breathing and smoking habit.
9. Subjects with orthodontic and prosthodontic appliances
10. History of undergoing nonsurgical and surgical periodontal therapy within the last 6 months.

Study design and clinical measurements

A randomized, parallel group clinical study was conducted on 40 systemically healthy patients reporting to the outpatient Department of Periodontology, at Subharti Dental College, Meerut with Chronic gingivitis.

The clinical parameters were assessed for plaque and gingival inflammation by recording the plaque index (PI)[5], gingival index (GI)[6], Bleeding on probing (BOP)[7] and oral hygiene index-simplified (OHI-S)[8] by a single investigator experienced with index system recording at baseline. Thorough scaling and polishing were performed,and the patients were randomly divided into two groups consisting of 20 patients each as under:

Group A - Supra and Subgingival scaling alone (hand instruments + ultrasonic scalers).

Group B - Supra and Subgingival scaling (hand instruments + ultrasonic scalers) + Gutcade capsules (500mg once a day for 21 days)

An informed written consent was obtained from each patient included in the study.

The patients in Group B were given gutcade capsules (a probiotic formulation containing Saccharomyces faecalis, Clostridium butyricum, Bacillus mesentericus and Lactobacillus acidophilus). The patients were asked to take a 500mg capsule once a day. The clinical parameters of PI, GI, BOP and OHI-S were recorded at baseline and 3 weeks post scaling.

RESULTS

P values of all clinical parameters showed statistically significant improvement in both the groups from baseline to 3 weeks ($p<0.001$).

Table 1 Intergroup comparison of clinical parameters between Group- A & Group-B from baseline 3 weeks later

	GROUP A			GROUP B		
	Baseline	3 Weeks	P value	Baseline	3 Weeks	P value
Gingival Index (Mean±SD)	1.3±0.17	1.0±0.09	<0.001	1.4±0.15	0.5±0.10	<0.001
Plaque Index (Mean±SD)	1.3±0.13	1.0±0.14	<0.001	1.5±0.14	0.6±0.12	<0.001
OHI (Mean±SD)	3.3±0.22	2.2±0.19	<0.001	3.2±0.33	2.1±0.15	<0.001
BOP(%) (Mean±SD)	57.7±13.88	30.5±9.47	<0.001	59.8±7.71	14.4±4.97	<0.001

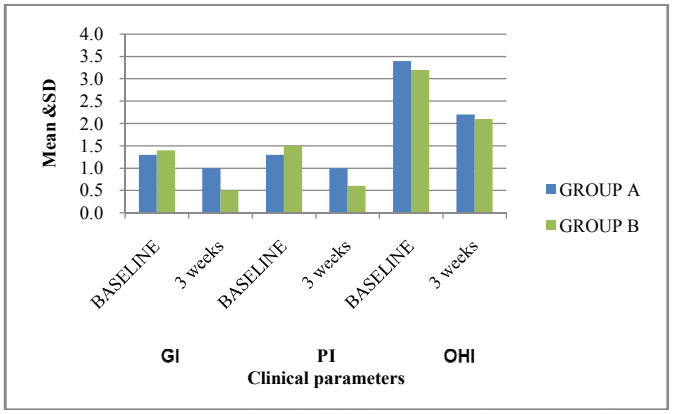

Figure 1 Intergroup comparison of Clinical Parameters between Baseline & 3 weeks post scaling

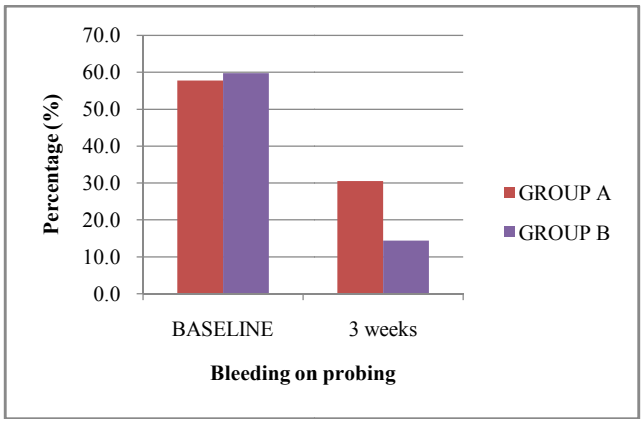

Figure 2 Intergroup comparison of Bleeding on Probing between Baseline & 3 weeks post scaling

DISCUSSION

Probiotic technology represents a breakthrough approach to maintain oral health by utilizing natural beneficial bacteria commonly found in healthy mouths to provide a natural defense against those bacteria thought to be harmful to teeth and gums.[9]

Probiotic species mostly belong to the genera Lactobacillus and Bifidobacterium. To be able to exert probiotic properties in the oral cavity, however, it is essential for the microorganism to resist the oral environmental conditions and defense mechanism, to be able to colonize and grow in the mouth, and to inhibit oral pathogens. The putative probiotic species also needs to be safe for the host.[1]

The potential benefits of probiotics on systemic health and medical disorders, such as gastrointestinal diseases, have been elaborately described.[10] The first species introduced into research were Lactobacillus acidophilus (L.acidophilus)and Bifidobacterium bifidum (B. bifidum). Among several potential benefits that have been proposed are reduced susceptibility to infections, reductions in allergies, and lactose intolerance, as well as lowered blood pressure and serum cholesterolvalues. A study with lactobacilli strains such as L. rhamnosus, Lactobacillus casei, Lactobacillus reuteri, or a lactobacilli mix have revealed mixed results on oral microorganisms.[11]

A variety of mechanisms have been proposed for their actions, and some effects have been stated to be systemic rather than only local. It is likely that these mechanisms vary according to the specific strain or combinations of strains used, the presence

of prebiotics and the condition that is being treated, as well as the stage of the disease process in which the probiotic is administered.[12]

There are common themes emerging in studies of the modes of action of probiotics and numerous mechanisms have been proposed including prevention of adhesion of pathogens to host tissues, stimulation, and modulation of the mucosal immune system, e.g., by reducing production of pro‐inflammatory cytokines through actions on NFkB pathways, increasing production of anti‐inflammatory cytokines such as interleukin‐10 (IL‐10), and host defense peptides such as beta‐defensin 2, enhancing immunoglobulin A defenses, and influencing dendritic cell maturation. Killing or inhibition of growth of pathogens through production of bacteriocins or other products, such as acid or peroxide, which are antagonistic toward pathogenic bacteria has also been reported.[13]

The current concept concerning the etiology of periodontal disease considers three groups of factors which determine whether active periodontal disease will occur: A susceptible host, the presence of pathogenic species, and the absence of so‐called "beneficial bacteria."[14]

Few experimental studies have explored the use of probiotic in periodontal diseases. Shimauchi *et al*.[15] administered Lactobacillus salivarius containing tablets or xylitol containing placebo 3 times daily for 8 weeks in patients with moderate to severe gingivitis. The intake of tablets containing L. salivarius resulted in benefits in terms of pocket probing depth and PI in individuals at high‐risk of periodontal disease (smokers) as compared to a placebo control group.

In a study by Krasse *et al*.[16] moderate to severe gingivitis patients were given one of the two different L. reuteriformulations (LR‐1 or LR‐2) at a dose of 2 × 10 (8) CFU/day, or a corresponding placebo. Reduction inboth gingivitis and plaque scores in patients with moderate to severe gingivitis were seen.

Kõll‐Klais *et al*.[17] observed that *L. gasseri* strains isolated from periodontally healthy subjects were more efficient at inhibiting the growth of *Aa*than strains from periodontally diseased subjects, and also inhibited the growth of *P.gingivalis* and*P. intermedia*. This correlated with an inverserelationship between carriage of homofermentative lactobacilli and subgingival colonization by *Aa, P. gingivalis, and P. intermedia.*

Noordin and Kamin[18] conducted a trial among 90 school children and assigned them into placebo, chlorhexidine, and probiotic groups. Plaque scores were recorded at baseline (0 day), on 15th day (after 14 days of intervention), and 3 weeks (after discontinuation of intervention). Probiotic mouthrinse was more effective for inhibition of dental plaque accumulation after 14 days of intervention and also after 3 weeks of discontinuation of intervention.

Vivekananda *et al*[19] evaluated the effects of L.reuteri (prodentis) alone and in combination with scaling and root planing (SRP) in patients with chronic periodontitis for a period of 42 days. Their trial confirmed the plaque inhibition, anti‐inflammatory, and antimicrobial effects of L. reuteri (prodentis) and they recommended the use of probiotic during nonsurgical and maintenance phase of periodontal treatment.

Harini and Anegundi [20] and Purunaik *et al*[21] evaluated clinically the efficacy of a probiotic and chlorhexidine mouthrinses on plaque and gingival scores and concluded that the probiotic mouthrinse was found effective in reducing plaque accumulation and gingival inflammation ($P < 0.001$).

Teughels *et al*.[22] in a randomized placebo‐controlled clinical trial evaluated the effects of L. reuteri ‐ containing probiotic lozenges and placebos as an adjunct to SRP in 30 patients with chronic periodontitis, monitored clinically, and microbiologically at baseline, 3, 6, 9, and 12 weeks after therapy. Significant improvement in all clinical parameters reduced P. gingivalis levels, more pocket depth reduction and attachment gain in moderate and deep pockets was observed in the SRP + probiotic group($p < 0.05$).

CONCLUSION

In the recent times, when organisms are fast developing resistance to antibiotics, the emergence of probiotics appears to be a boon for the treatment of diseases. Researchers have confirmed that diseases of the periodontium are not confined to the oral cavity but have strong systemic effects. Hence, probiotics offer a natural and promising option to establish both a good oral and systemic health. In the present study, the probiotics tested was effective in reducing plaque accumulation and gingival inflammation. Therefore, probiotics have a potential therapeutic value, and further long‐term studies are recommended to determine its efficacy.

Disclosure Statement

All authors revealed no conflict of interest.

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