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## Association of Periodontal Health Status and Diet in Dhamangaon Population: A Cross-Sectional Study

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### KEYWORDS

Periodontal Health, Diet, Probiotics, Oral Hygiene, Periodontal Diseases, Gingival Index, Plaque Control, Systemic Health,

### ABSTRACT:

**Background:** The diet plays a crucial role in maintaining the health of the periodontium. A balanced diet rich in vitamins, minerals, and antioxidants supports tissue repair, collagen synthesis, and immune function, reducing the risk of periodontal diseases. The inclusion of probiotics in the diet can have a beneficial impact on the periodontium by promoting oral and systemic health. Probiotics help modulate the oral microbiota, reducing the prevalence of pathogenic bacteria associated with periodontal diseases.

**Objective:** To find out the association between periodontal health status and diet in Dhamangaon population and to know

**Method:** A total of 384 participants, aged 20 to 55 years and representing diverse urban and rural populations, were screened at dental camps. The study included individuals consuming probiotic foods and those who were not. Oral health assessments were conducted using the Oral Hygiene Index (Simplified) and the Gingival Index. Additionally, a validated questionnaire was used to gather supplementary data. Statistical analysis will be performed using the Chi-square test to explore associations within the data.

**Results:** The study found a significant positive association between the consumption of probiotic foods and oral hygiene status in the Dhamangaon population. Participants who regularly consumed probiotic-rich foods, such as yogurt, fermented dairy products, and other probiotic supplements, demonstrated better oral hygiene compared to those who did not consume probiotics. Overall, the findings advocate for the inclusion of probiotics in the diet as part of a preventive approach to maintaining periodontal health. This study also provides evidence that dietary modifications, especially the consumption of probiotic foods, could be an



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effective, low-cost strategy for promoting better oral hygiene and overall oral health.

**Conclusion:** Periodontal diseases, which are primarily caused by the accumulation of bacterial plaque and tartar, result in inflammation of the gingiva and can lead to further attachment loss of the teeth. The study indicates that the inclusion of probiotics in the diet may offer a promising solution for mitigating these issues. Probiotics contribute to oral health by reducing plaque buildup, neutralizing free radicals, and helping to modulate the body's immune system. Additionally, probiotics regulate mucosal permeability, which can have a positive impact on oral tissues and reduce inflammation. By promoting a healthy oral microbiota and reducing the prevalence of harmful bacteria, probiotics offer a low-cost, accessible intervention that could complement traditional oral health practices. Therefore, the inclusion of probiotic-rich foods in daily diets may serve as a beneficial tool for reducing the risk of periodontal diseases and enhancing long-term oral health.

## 1. Clinical Relevance-

**Background:** The diet plays a crucial role in maintaining the health of the periodontium. A balanced diet rich in vitamins, minerals, and antioxidants supports tissue repair, collagen synthesis, and immune function, reducing the risk of periodontal diseases. The inclusion of probiotics in the diet can have a beneficial impact on the periodontium by promoting oral and systemic health. Probiotics help modulate the oral microbiota, reducing the prevalence of pathogenic bacteria associated with periodontal diseases.

**Added value of this study:** A diet including probiotics may play a supportive role in managing advanced gingivitis by influencing the microbial and inflammatory environment of the periodontium. The population selected here were not aware of probiotic word /its use. By default, some people were having probiotic rich food in their diet because they were pastoralists having good periodontal health which was an example for others. This study educated people to have proper diet as well as to visit dentists regularly.

**Clinical implications:** Incorporating probiotic-rich foods (e.g., yogurt etc) or supplements into a balanced diet can complement conventional periodontal therapies like scaling and root planing (SRP). Probiotics can enhance treatment outcomes by targeting the microbial imbalance and inflammatory processes that drive periodontal destruction.

## 2. Introduction

The word diet often implies the use of specific intake of nutrition for optimum health. Probiotics are living

microbes, or as food ingredients containing living microbes, that beneficially influence the health of the host when used in adequate numbers<sup>1,2</sup>

The Agriculture Organization of the United States and the World Health Organization defined<sup>3</sup> probiotics in 2001 as bacteria that, when given to a host at adequate levels, improve their health. Probiotics are foods and/or supplements that contain non-pathogenic microbes such as bacteria and yeast that colonize the gut and can potentially yield a variety of health benefits.<sup>4</sup>

Lactobacillus and Bifidobacterium are the two most frequently used genera. These bacteria are generally thought of as harmless due to their ability to survive in the body to cure and prevent diseases, unlike the usual pathogens.<sup>5</sup> They are naturally found in fermented foods like yogurt, kefir, sauerkraut, kimchi, and certain types of cheese. They can also be taken as dietary supplements, often in the form of capsules or powders.

The benefits include the prevention of acute diarrhoea, Crohn's disease, cardiovascular and urogenital infections, cancer, lactose intolerance, cystic fibrosis, dental caries, and oral diseases. Bacteria may also be beneficial in preventing tooth decay, reducing gingival inflammation, arresting further advancement of advanced gingivitis, treating periodontal disease, and reducing oral malodor. Probiotic's beneficial role in preventing inflammatory disorders is an ever-expanding list.<sup>6</sup>

Gingivitis is common term used to denote inflammation of gum tissues and periodontitis is a chronic inflammatory disease that affects the tissues supporting



the teeth, including the gums, periodontal ligaments, and alveolar bone. It is caused by a bacterial infection that leads to progressive destruction of the tooth-supporting structures.

Probiotics have been demonstrated to be effective in preventing periodontal tissue destruction by changing the host defence system and preventing the release of proinflammatory cytokines that can mediate tissue destruction.<sup>7</sup> The use of probiotics in managing periodontitis is an emerging area of interest in dental health. Probiotics competes with harmful bacteria for adhesion sites, nutrients, growth factors.

This all inhibits growth of pathogens in the oral cavity and disrupts the plaque ecology subsequently there is reduced inflammation which is beneficial for the optimum periodontal health.<sup>8,9</sup> Integrating probiotics into periodontal care may offer complementary support to traditional treatments like scaling and root planing, antibiotics, and improved oral hygiene practices. Non-Surgical Periodontal Therapy (NSPT) is the gold standard for managing periodontitis, focusing on mechanical debridement through scaling and root planing (SRP). However, the adjunctive use of probiotics is gaining interest as an effective strategy to modulate the oral microbiome and enhance periodontal healing.

Despite the growing interest in probiotics as an adjunct to periodontal therapy, the available literature remains limited about probiotics in periodontal therapy. The goal of this research is to determine the association between nutritional intake and periodontal well-being.

### 3. Method –

This cross-sectional study was conducted over a period of two months at Dhamangaon, District Nashik, Maharashtra, India, among individuals attending dental camps. The study population included both urban and rural participants of any gender, aged between 20 and 55 years. The sample size of 384 participants was determined using a formula  $n = \frac{[Z]^2 [P(P-1)]}{d^2}$  based on expected proportions from existing literature, with a confidence level of 95% and a margin of error of 5%. Patients with habits like tobacco use, smoking, medical conditions causing gingival hyperplasia, or who were pregnant were excluded from the study.

The study details have been communicated to the patients. Simple random sampling techniques were

employed to select participants meeting the inclusion criteria. During the dental camps, participants underwent oral examinations where Oral Hygiene Index-Simplified (OHI-S), Gingival Index (GI), and measurements were recorded, alongside self-administered questionnaires. Content validation of questionnaire was found to be 0.89 when assisted by recording variables. A single examiner conducted the study by taking demographic data, administering questionnaires and performing intraoral examinations. Descriptive statistical methods were used for further analysis using SPSS V26. Institutional ethical clearance was obtained at SMT Institute of Dental Sciences and Research.

### 4. Results

According to the questionnaire responses, data were collected on patients' oral health habits. Regularity of dental visits was assessed alongside Oral Hygiene Index-Simplified (OHI-S) and Gingival Index (GI) evaluations. Patients who visited the dentist within 3 to 6 months had consistently "Good" oral health. At the 1-year mark, most responses shifted to "Fair" (81.8%), while those who couldn't recall their last visit had a mix of "Fair" (80.6%) and "Poor" (19.4%) ratings.

Oral hygiene methods were also analyzed. Patients who brushed their teeth had a mix of "Good" (39.1%) and "Fair" (60.9%) OHI-S scores. Those using water or Miswak predominantly had "Fair" scores (100%), while patients unaware of their hygiene habits had "Poor" scores (100%).

Dietary habits showed a significant link to oral hygiene. Patients with a mixed diet primarily had "Fair" (78.6%) OHI-S scores, with some reporting "Good" (7.1%) or "Poor" (14.3%). Those following a vegetarian diet had a more balanced distribution, with 44.1% "Good" and 55.9% "Fair" scores, with no "Poor" ratings.

The Gingival Index (GI) assessment mirrored OHI-S findings. Patients visiting the dentist within 6 months had only mild gingivitis. At the 1-year mark, 36.4% had mild gingivitis, while 63.6% had moderate cases. Among those uncertain about their last visit, 22.6% had mild, 58.1% had moderate, and 19.4% had severe gingivitis.

Oral hygiene methods also influenced gingival health. Tooth brushing was associated with mild (67.4%) and moderate (32.6%) gingivitis. Washing with water resulted in moderate gingivitis (100%), while Miswak



users had 83.3% moderate and 16.7% severe gingivitis. Patients unaware of their hygiene habits reported 50% moderate and 50% severe gingivitis, with no mild cases.

For patients who reported using probiotics, 92(23.9%) had a "Good" OHI-S score, reflecting superior oral hygiene. In contrast, 185 (48.2%) patients had a "Fair" OHI-S score, indicating moderate oral hygiene, while 30(7.8%) had a "Poor" OHI-S score, showing relatively poor oral hygiene despite adherence to the practice. Among patients who did not use probiotics, only a small number achieved a "Good" OHI-S score, suggesting poorer overall oral hygiene. Meanwhile, 77(20.0%) patients in this group had a "Fair" OHI-S score, reflecting moderate oral hygiene. (Table :1)

The relationship between the frequency of probiotic food intake (OHI-S) scores. Among participants who consumed probiotics once a day, all reported "Good" OHI-S scores. Those who consumed probiotics once a week had the highest percentage of "Fair" scores (40.1%) and no "Poor" scores. Participants who consumed probiotics once a month mostly had "Fair" scores (15.9%), while those who never consumed probiotics had a mix of "Fair" (12.2%) and "Poor" (7.8%) scores. Overall, the majority of participants had "Fair" OHI-S scores, regardless of their probiotic intake frequency. (Table :2)

The habit of consuming probiotic tablets / using toothpaste was checked. But there was a poor response. People were not aware of these products. But still due to some habits we got varying results showing good, fair, poor oral hygiene. 92 (23.9%) patients were having good oral hygiene, 262(68.2%) had fair and 30 (7.8%) have poor oral hygiene. All of them were not aware of using mentioned products for better oral hygiene. (Table:3)

The distribution of Gingival Index (GI) scores based on probiotic food consumption. Among participants who consumed probiotics, the majority had "Mild" (40.1%) and "Moderate" (35.9%) gingivitis, with a smaller portion having "Severe" gingivitis (3.9%). In contrast, those who did not consume probiotics had a higher percentage of "Moderate" (15.9%) and "Severe" (4.2%) gingivitis, with no cases of "Mild" gingivitis. (Table:4)

Among those who consumed probiotics once a day (12.0%, 46 participants), all had "Mild" gingivitis. For those who consumed probiotics once a week (52.1%, 200

participants), 40.1% had "Mild" and 32.0% had "Moderate" gingivitis. Among participants who consumed probiotics once a month (15.9%, 61 participants), 8.1% had "Mild" and 7.8% had "Moderate" gingivitis. Those who never consumed probiotics (20.1%, 77 participants) had 12.2% "Moderate" and 8.1% "Severe" gingivitis. (Table:5)

The habit of consuming probiotic tablets / using toothpaste was checked. But there was a poor response. People were not aware of these products. But still due to some habits we got varying results showing mild moderate severe gingivitis (Table:6)

## 5. Discussion

The findings of this study highlight the significant influence of oral hygiene practices, frequency of dental visits, and probiotic intake on the severity of gingivitis. The strong association observed through the Chi-Square test underscores the critical role of maintaining regular oral health routines. The professional dental care plays a pivotal role in preventing the progression of gum disease.

Haukioja et al. (2010)<sup>1</sup> explored the role of probiotics in oral health, particularly their impact on the microbial composition of the oral cavity. The study found that probiotic bacteria, particularly those from the *Lactobacillus* and *Bifidobacterium* genera, might influence the balance of oral microbiota, potentially lowering the risk of periodontitis by inhibiting the growth of pathogenic bacteria.

The role of probiotics in oral health was particularly noteworthy. Daily consumption of probiotic-rich foods resulted solely in mild gingivitis cases, whereas less frequent intake was associated with moderate severity. Non-consumers exhibited the highest severity levels, demonstrating the potential of probiotics in modulating oral microbiota and reducing gum inflammation. This aligns with existing literature on the anti-inflammatory and antimicrobial properties of probiotics, which contribute to improved gingival health.

In some of the studies the administration of the probiotic as an adjunct to efficacious mechanical plaque control significantly enhanced the reduction of gingival inflammation. Probiotics reduce plaque induction by neutralizing free electrons, modulating systemic immune system and also by regulating mucosal permeability. Strains of *Streptococcus thermophilus* and *Lactococcus*



*lactis* strains were shown to adhere to saliva coated hydroxyapatite beads in an in-vitro study.<sup>10</sup>

Bodke and Jogdand (2022)<sup>4</sup> reviewed the overall benefits of probiotics in human health, with a focus on their potential role in managing oral diseases. They emphasized that probiotics could help restore the balance of the oral microbiome, reduce inflammation, and inhibit the progression of periodontal disease. Probiotics may provide an adjunctive therapeutic option alongside traditional periodontal treatments like scaling and root planing.

Gingivitis is caused by the accumulation of bacterial plaque and tartar leading to the inflammation of the gingiva or gums. The most common causative organism is *Porphyromonas gingivalis*, which colonize sub gingival sites and cause tissue damage by invading gingival epithelial cells leading to progression of chronic inflammatory diseases. GI (Gingival Index) and BOP (Bleeding on probing) is the markers of inflammation and represents parameters of gingivitis. Gingipain proteases produced by the pathogenic bacteria contribute to the virulence of the organism by disrupting the host complement system.<sup>11</sup>

Reid et al. (2003)<sup>6</sup> discussed the clinical applications of probiotics, highlighting their use in managing oral infections, including periodontitis. Probiotics were found to help in maintaining oral health by modulating the immune system and producing antimicrobial substances, which could prevent the growth of periodontal pathogens like *Porphyromonas gingivalis*.

Probiotic strains help in managing gingivitis by stabilizing the flora of the oral cavity. Acidogenic probiotic bacteria such as *Lactobacilli*, *Streptococci* and *Bifidobacterium* release antimicrobial substances that have inhibitory effect against pathogens through co-aggregation, production of toxic byproducts and competing for substrates. Nisin, a commercially available antimicrobial agent found effective in the reduction of plaque buildup and gingivitis in beagle dogs as compared to treatment with chlorhexidine and a placebo.<sup>12</sup>

However, limited awareness regarding probiotic-based oral health products, such as tablets and toothpaste, was evident in the poor response rate for these items. This indicates a need for greater public education and

awareness campaigns to promote the benefits of probiotics in oral care.

The limitations of this study include several factors that may have influenced the results. Firstly, the study design was cross-sectional, meaning it captures data at a single point in time rather than tracking changes over a longer period. The sample population was limited to individuals attending dental camps, which may not represent the general population, particularly those who do not seek regular dental care. This could result in selection bias, limiting the generalizability of the findings. Additionally, the study did not assess the specific strains of probiotics consumed or the doses, which may play a significant role in their efficacy. Furthermore, factors such as lifestyle, genetics, and overall health conditions were not controlled for, which could also influence the severity of gingivitis.

## 6. Conclusion

This study highlights the significant role that oral hygiene practices, dental visit frequency, and probiotic intake play in maintaining optimal gingival health. Regular dental visits, along with proper brushing habits, were shown to significantly reduce the severity of gingivitis and contribute to better overall oral hygiene. The use of probiotics, especially when consumed regularly, demonstrated a positive effect on gum health, with participants who consumed probiotics daily showing the mildest symptoms of gingivitis. This supports the growing body of evidence suggesting that probiotics can help modulate the oral microbiota, reduce inflammation, and potentially prevent periodontal diseases.

However, despite these promising findings, the study also uncovered limitations that must be addressed in future research. The poor awareness regarding probiotic-based oral care products and the limited response rate to questions about their usage suggests a critical gap in public knowledge. Educating the public about the benefits of probiotics in oral health is essential for maximizing their potential. Furthermore, the cross-sectional nature of the study means that conclusions about long-term effects cannot be drawn, and additional longitudinal studies are needed to track the effects of these habits over time.



Overall, the study provides valuable insights into the relationship between diet, oral hygiene, and gingival health, emphasizing the importance of both professional care and self-care practices in preventing and managing gingivitis. While the role of probiotics is promising, further investigation into their specific strains, dosages, and long-term effects on oral health is necessary. These findings highlight the need for more comprehensive health education programs to improve public understanding and encourage better oral hygiene habits.

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**Table 1: Association between Consumption of probiotic food and OHI-S**

		OHIS			Total
		Good	Fair	Poor	
Consumption of probiotic food	Yes	92 (23.9%)	185 (48.2%)	30 (7.8%)	307 (80.0%)
	No	0	77	0	77 (20.0%)
Total		92 (23.9%)	262 (68.2%)	30 (7.8%)	384 (100%)

The Chi-square test statistic of 44.84 indicates a strong association between the intake of probiotic rich food and the perceived oral hygiene status.

**Table 2: Association between frequency of intake of probiotic food and OHI-S**

		New OHIS			Total
		Good	Fair	Poor	
Frequency of intake of probiotic food	Once a day	46 (12.0%)	0	0	46 (12.0%)
	Once a week	46 (12.0%)	154 (40.1%)	0	200 (52.1%)



	New OHIS			Total
	Good	Fair	Poor	
Once a Month	0	61 (15.9%)	0	61 (15.9%)
Never	0	47 (12.2%)	30 (7.8%)	77 (20.1%)
Total	92 (23.9%)	262 (68.2%)	30 (7.8%)	384 (100%)

This showed p (value 0.01) statistically significant association between frequency of intake of probiotic rich food and oral hygiene. Chi square Value 307.01

**Table 3: The habit of consuming probiotic tablets / using toothpaste and OHI-S**

		OHIS			Total
		Good	Fair	Poor	
	No	92 (23.9%)	262 (68.2%)	30 (7.8%)	384 (100%)
Total		92 (23.9%)	262 (68.2%)	30 (7.8%)	384 (100%)

There is no awareness about probiotic rich tablets /toothpastes or other products. Number variation according to their personal gingival health

**Table 4: Association between Consumption of probiotic food and GI**

		GI			Total
		Mild	Moderate	Severe	
Consumption of probiotic food	Yes	154 (40.1%)	138 (35.9%)	15 (3.9%)	307 (80.0%)
	No	0	61 (15.9%)	16 (4.2%)	77 (20.0%)
Total		154 (40.1%)	199 (51.9%)	31 (8.1%)	384 (100%)

The Chi-square test statistic of 71.83 indicates a strong association between the intake of probiotic rich food and the perceived oral hygiene status

**Table 5: Association between frequency of intake of probiotic food and GI**

		GI			Total
		Mild	Moderate	Severe	
Frequency of intake	Once a day	46 (12.0%)	0	0	46 (12.0%)
	Once a week	77 (20.1%)	123 (32.0%)	0	200 (52.1%)
	Once a Month	31 (8.1%)	30 (7.8%)	0	61 (15.9%)
	Never	0	46 (12.0%)	31 (8.1%)	77 (20.1%)
Total		154 (40.1%)	199 (51.9%)	31 (8.1%)	384 (100%)

Chi square Value 225.96, p Value 0.01\*

There is association between frequency of intake of probiotic rich food and gingival health

**Table 6: The habit of consuming probiotic tablets / using toothpaste and GI**

		GI			Total
		Mild	Moderate	Severe	
Q6	No	154 (40.1%)	199 (51.9%)	31 (8.1%)	384 (100%)
Total		154 (40.1%)	199 (51.9%)	31 (8.1%)	384 (100%)

There is no awareness about probiotic rich tablets /toothpastes or other products.

Number variation according to their personal gingival health