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## Knowledge and awareness of probiotics among dental students: A cross sectional study

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### Abstract

**Background:** Probiotics are live microorganisms that provide health benefits when consumed in adequate amounts, especially in oral health. Despite increasing evidence of their benefits in preventing oral infections, awareness among dental professionals remains limited. This study assesses the awareness of probiotics among dental students at a private dental college in Chennai.

**Methods:** A cross-sectional study was conducted among 104 dental students using a structured questionnaire on probiotics. Data were analyzed using IBM SPSS Statistics, with statistical tests like Pearson's chi-square and Fisher's exact test to assess associations between awareness and academic levels.

**Results:** The study found varying levels of awareness across different academic years. Undergraduate students showed slightly better awareness than postgraduates, with significant gaps in knowledge about probiotics' role in oral health, natural sources, and key constituents.

**Conclusion:** In this cross-sectional study students shows limited awareness about probiotics, which highlights the need of enhanced education in dental curriculum to address knowledge gaps and barriers regarding probiotic use in dental practice.

**Keywords:** Probiotics, lactobacillus, candida albicans, oral cancer, oral flora

### Introduction

Probiotics are a subject of extensive research in food and nutritional science. The term "probiotics" is derived from Greek, meaning "for life," and refers to substances produced by microorganisms that stimulate growth. Probiotics are live microbes that, when consumed in adequate amounts, offer health benefits to the host <sup>[1]</sup>. They are commonly found in forms like powders, liquids, gels, and capsules, and are often used as food ingredients, particularly in dairy products and fermented plant foods. In dentistry, probiotics have gained significance due to their potential in preventing oral infections, which are common among humans. The most commonly used probiotic strains are from the Lactobacillus genus, which are frequently found in the oral cavity, including lesions <sup>[2]</sup>. Probiotics are known for their ability to inhibit harmful bacterial species and promote health by stimulating beneficial oral flora, reversing imbalances, and effectively fighting harmful microorganisms. Clinical evidence supports the role of probiotics in preventing and treating dental caries, periodontal diseases, and halitosis <sup>[3]</sup>. An ideal probiotic should have high viability, resistance to low pH and acids, the ability to persist in the intestine, and interact with gut epithelium to influence local metabolic activity. Probiotics are also involved in maintaining a healthy gut environment, and their antimicrobial properties are crucial for their function in suppressing pathogenic bacteria and enhancing gut immunity. Probiotics have shown promise in treating periodontitis, often proving as effective as chlorhexidine and sodium fluoride mouthwashes. They help reduce the pH of the oral cavity, preventing the formation of plaque and calculus, which contribute to periodontal diseases <sup>[4]</sup>.

Probiotics are also effective against fungi like Candida albicans, and have shown benefits in treating conditions such as constipation, colic, dental caries, and respiratory infections. With increasing awareness of the link between diet and health, the market for probiotic products has

expanded. Probiotics not only support gut health but may also lower inflammation in the body, potentially reducing inflammatory diseases like ulcerative colitis. Their role in inhibiting oral cancer by slowing the growth of cancerous cells has also been explored. As the understanding of probiotics' benefits continues to grow, they are becoming an integral part of health management [5]. Despite the growing body of evidence supporting the benefits of probiotics for oral and systemic health, there is limited awareness of their role among dental professionals. This lack of awareness may prevent the effective integration of probiotics into clinical dental practice, thereby hindering their potential as a complementary treatment option for oral health conditions [6]. This study aims to assess the level of awareness of probiotics among dental students, as early education in this area can positively influence future practice and patient care.

### Materials and Methods

This research used a cross-sectional design to assess the awareness of probiotics among dental students at a private dental college in Chennai. The study involved dental students from different academic years, and data were collected using a structured questionnaire comprising 15 questions related to probiotics awareness. The questionnaire was reviewed and approved by the Department of Oral Medicine and Radiology at the college. Ethical clearance was obtained from the Institutional Review Board (IRB), and informed consent was gathered from all participants, ensuring their voluntary participation. The study maintained participant anonymity and data confidentiality, with no personally identifiable information collected. To collect responses, the questionnaire was distributed via Google Forms through various social media platforms, and a total of 104 dental students participated. The data were transferred to Excel and analyzed using IBM SPSS Statistics (Version 26.0). Descriptive statistics, including frequencies and percentages, were calculated for all responses, and comparisons across different educational levels were made using cross-tabulations. Statistical significance was assessed using Pearson's chi-square test and Fisher's exact test, with a significance level set at  $p < 0.05$ .

### Results and discussion

The study on awareness regarding probiotics among dental students had participants with a mean age of 22.33 years, with an age range between 19 and 28 years. The demographic breakdown of the participants showed that 51% were undergraduate (UG) students, 11.5% were postgraduate (PG) students, and 37.5% were interns. Regarding general awareness, 36% of CRRJ students, 45.2% of UG students, and 9.6% of PG students were aware of the term "probiotics," with a p-value of 0.656, indicating no significant difference between the groups. When asked about the definition of probiotics, 31.7% of CRRJ students correctly identified probiotics as live bacteria beneficial for health, compared to 44.2% of UG students and 11.5% of PG students, with a p-value of 0.744. Awareness of the benefits of probiotics for oral health was moderate, with 26% of CRRJ students, 36.5% of UG students, and 10.6% of PG students confirming they had heard of the benefits, yielding a p-value of 0.624, indicating no significant difference.

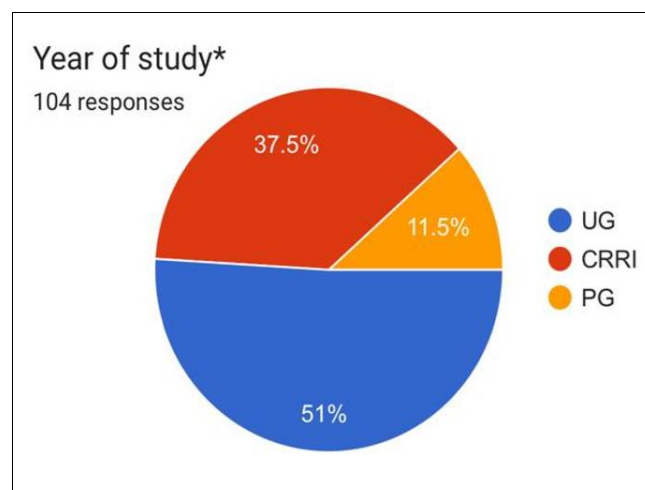
In terms of the potential benefits of probiotics for oral health, including reducing tooth decay and preventing gum diseases, 26.9% of CRRJ students, 42.3% of UG students, and 10.6% of PG students recognized both benefits, with a p-value of

0.713. Regarding the most commonly used probiotic strains, 25% of CRRJ students, 26.9% of UG students, and 4.8% of PG students correctly identified *Lactobacillus* and *Bifidobacterium* as common strains, with a p-value of 0.430. When asked about natural sources of probiotics, 24% of CRRJ students, 35.6% of UG students, and 10.6% of PG students correctly identified yogurt, cheese, and fermented rice-based foods as sources, with a p-value of 0.705.

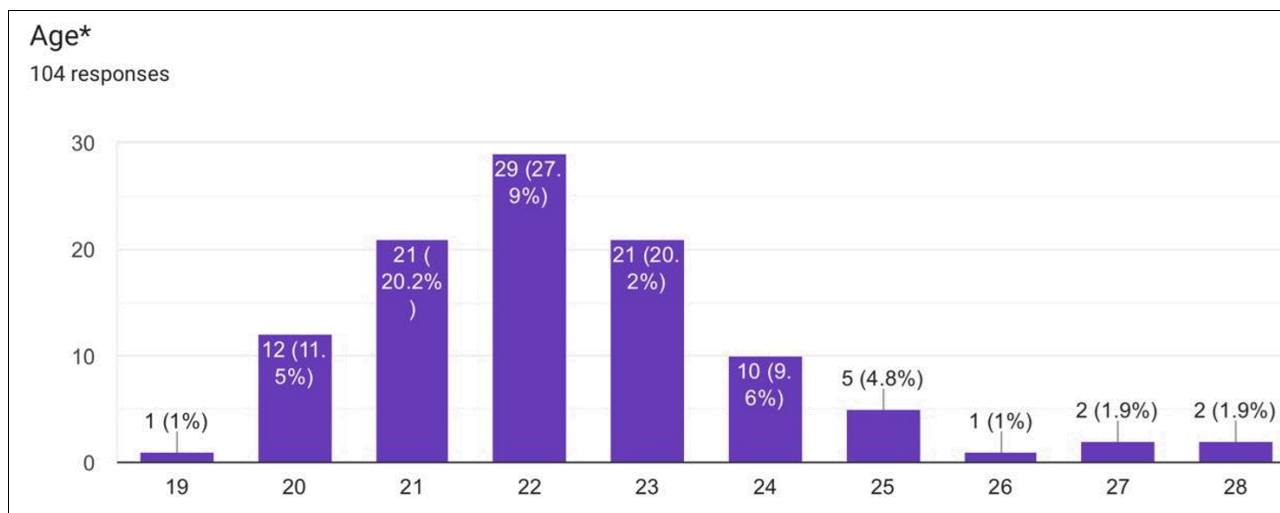
In terms of the properties of probiotics, 26% of CRRJ students, 40.4% of UG students, and 8.7% of PG students identified the key properties (non-toxic, non-pathogenic, and able to withstand gastrointestinal juice), with a p-value of 0.169. When asked which patients probiotics can be recommended for, 25% of CRRJ students, 37.5% of UG students, and 7.7% of PG students identified all of the above conditions (periodontal diseases, dental caries, xerostomia), with a p-value of 0.833.

Regarding the frequency of probiotics in dental caries prevention, 16.3% of CRRJ students, 13.5% of UG students, and 2.9% of PG students preferred daily use, with a p-value of 0.364. For how probiotics reduce the risk of dental caries, 17.3% of CRRJ students, 17.3% of UG students, and 7.7% of PG students correctly stated that probiotics decrease the growth of harmful streptococcus species, with a p-value of 0.470. When asked if probiotics were adequately covered in the dental curriculum, 18.3% of CRRJ students, 16.3% of UG students, and 6.7% of PG students reported extensive coverage, with a significant p-value of 0.002, indicating a notable difference in the curriculum coverage perception.

Barriers to using probiotics in dental practice included lack of evidence, patient awareness, cost, and availability. 20.2% of CRRJ students, 28.8% of UG students, and 7.7% of PG students identified patient awareness as the major barrier, with a p-value of 0.328. For the constituents of probiotics, 24% of CRRJ students, 26.9% of UG students, and 8.7% of PG students correctly identified live organisms as the main constituents, with a p-value of 0.021, indicating a statistically significant difference between the groups. Finally, when asked about oral conditions where probiotics can be used, 22.1% of CRRJ students, 36.5% of UG students, and 6.7% of PG students correctly identified all of the conditions (oral candidiasis, halitosis, periodontal inflammation), with a p-value of 0.593. Regarding the side effects of probiotics, including allergic reactions and gastrointestinal disturbances, 21.2% of CRRJ students, 26% of UG students, and 7.7% of PG students correctly identified both, with a p-value of 0.219.



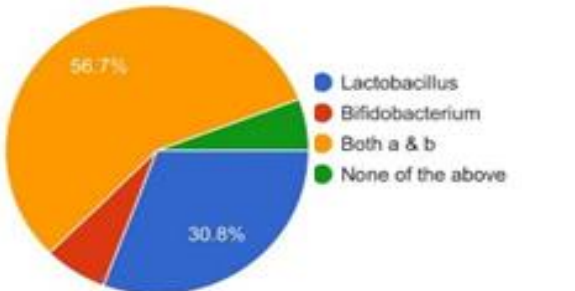
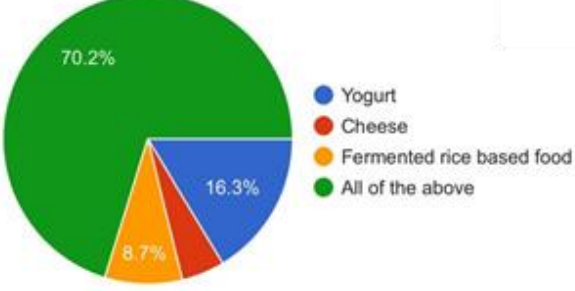
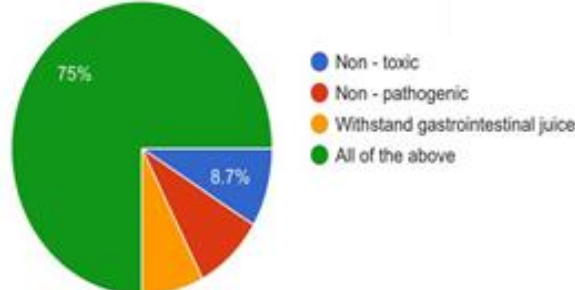
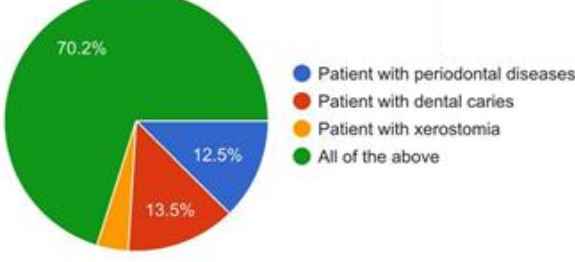

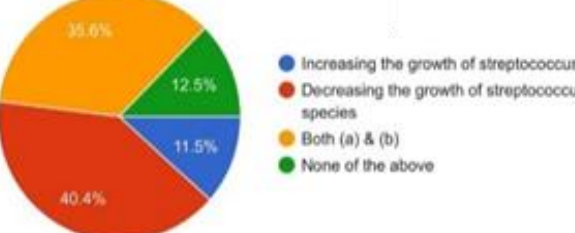
**Fig 1:** Distribution of participants based on year of study

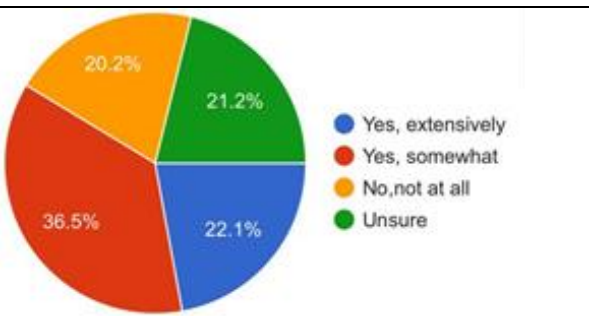
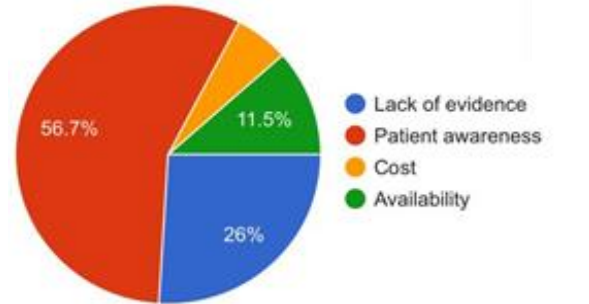
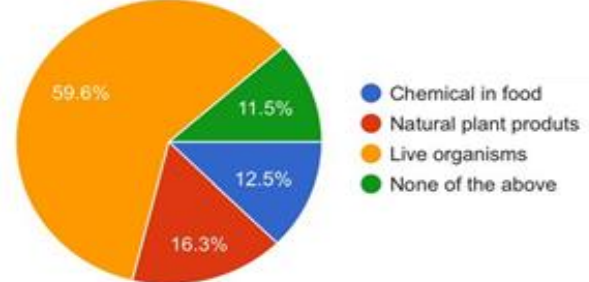
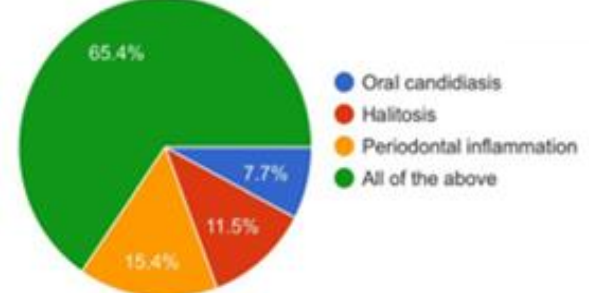
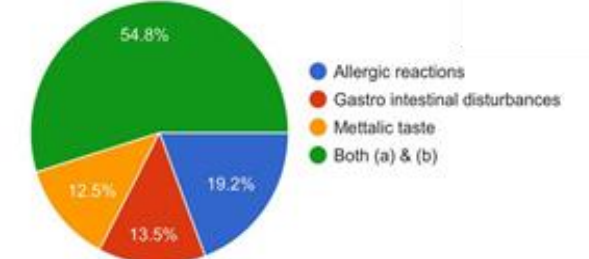


**Fig 2:** Distribution of participants based on age

**Table 1:** Distribution of response to questions along with pie chart representation

Question	Options	Year of study (%)			P-value	Pie chart representation of responses
		CRR1	UG	PG		
1) Are you aware of the term "probiotics"?	YES NO	36(34.6%) 3(2.9%)	47(45.2%) 6(5.8%)	10(9.6%) 2(1.9%)	0.656	
2) What are probiotics?	Antibiotics Artificial sweeteners Live bacteria beneficial for health Vitamins and minerals	0(0.0%) 3(2.9%) 33(31.7%) 3(2.9%)	1(1.0%) 2(1.9%) 46(44.2%) 4(3.8%)	0(0.0%) 0(0.0%) 12(11.5%) 0(0.0%)	0.744	
3) Have you ever heard of probiotics being beneficial for oral health?	No Not sure Yes	4(3.8%) 8(7.7%) 27(26.0%)	5(4.8%) 10(9.6%) 38(36.5%)	0(0.0%) 1(1.0%) 11(10.6%)	0.624	
4) What potential benefits do probiotics offer for oral health?	Reducing tooth decay Preventing gum diseases Whitening tooth Both (a) & (b)	5(4.8%) 4(3.8%) 2(1.9%) 28(26.9%)	5(4.8%) 3(2.9%) 1(1.0%) 44(42.3%)	1(1.0%) 0(0.0%) 0(0.0%) 11(10.6%)	0.713	

<p>5) What are the most used strains in probiotics?</p>	<p>Lactobacillus Bifidobacterium Both a &amp; b None of the above</p>	<p>10(9.6%) 3(2.9%) 26(25.0%) 0(0.0%)</p>	<p>17(16.3%) 3(2.9%) 28(26.9%) 5(4.8%)</p>	<p>5(4.8%) 1(1.0%) 5(4.8%) 1(1.0%)</p>	<p>0.430</p>	
<p>6) In whatever natural forms probiotics are available?</p>	<p>Yogurt Cheese Fermented rice based food All of the above</p>	<p>8(7.7%) 2(1.9%) 4(3.8%) 25(24.0%)</p>	<p>8(7.7%) 3(2.9%) 5(4.8%) 37(35.6%)</p>	<p>1(1.0%) 0(0.0%) 0(0.0%) 11(10.6%)</p>	<p>0.705</p>	
<p>7) What are the properties of probiotics?</p>	<p>Non – toxic Non – pathogenic Withstand gastrointestinal juice All of the above</p>	<p>2(1.9%) 5(4.8%) 5(4.8%) 27(26.0%)</p>	<p>4(3.8%) 4(3.8%) 3(2.9%) 42(40.4%)</p>	<p>3(2.9%) 0(0.0%) 0(0.0%) 9(8.7%)</p>	<p>0.169</p>	
<p>8) To what kind of patients probiotics can be recommended?</p>	<p>Patient with periodontal diseases Patient with dental caries Patient with xerostomia All of the above</p>	<p>5(4.8%) 7(6.7%) 1(1.0%) 26(25.0%)</p>	<p>6(5.8%) 5(4.8%) 3(2.9%) 39(37.5%)</p>	<p>2(1.9%) 2(1.9%) 0(0.0%) 8(7.7%)</p>	<p>0.833</p>	
<p>9) How often do you think probiotics should be incorporated into dental caries?</p>	<p>Daily Weekly Monthly Never</p>	<p>8(7.7%) 13(12.5%) 17(16.3%) 1(1.0%)</p>	<p>21(20.2%) 15(14.4%) 14(13.5%) 3(2.9%)</p>	<p>4(3.8%) 5(4.8%) 3(2.9%) 0(0.0%)</p>	<p>0.364</p>	
<p>10) How probiotics reduce the risk of dental caries?</p>	<p>Increasing the growth of streptococcus Decreasing the growth of streptococcus species Both (a) &amp; (b) None of the above</p>	<p>3(2.9%) 17(16.3%) 15(14.4%) 4(3.8%)</p>	<p>9(8.7%) 18(17.3%) 18(17.3%) 8(7.7%)</p>	<p>0(0.0%) 7(6.7%) 4(3.8%) 1(1.0%)</p>	<p>0.470</p>	

11) How well do you think probiotics are covered in your dental curriculum?	Yes, extensively Yes, somewhat No, not at all Unsure	5(4.8%) 19(18.3%) 12(11.5%) 3(2.9%)	17(16.3%) 12(11.5%) 7(6.7%) 17(16.3%)	1(1.0%) 7(6.7%) 2(1.9%) 2(1.9%)	0.002	
12) What are the primary barrier for using probiotics in dental practice? *	Lack of evidence Patient awareness Cost Availability	9(8.7%) 21(20.2%) 5(4.8%) 4(3.8%)	16(15.4%) 30(28.8%) 1(1.0%) 6(5.8%)	2(1.9%) 8(7.7%) 0(0.0%) 2(1.9%)	0.328	
13) what do you think constituents of probiotics?	Chemical in food Natural plant Products Live organisms None of the above	2(1.9%) 10(9.6%) 25(24.0%) 2(1.9%)	11(10.6%) 7(6.7%) 28(26.9%) 7(6.7%)	0(0.0%) 0(0.0%) 9(8.7%) 3(2.9%)	0.021	
14) what are the oral conditions in which probiotics can be used ?	Oral candidiasis Halitosis Periodontal Inflammation All of the above	2(1.9%) 6(5.8%) 8(7.7%) 23(22.1%)	5(4.8%) 5(4.8%) 5(4.8%) 38(36.5%)	1(1.0%) 1(1.0%) 3(2.9%) 7(6.7%)	0.593	
15) What are the side effects of probiotics? *	Allergic reactions Gastro intestinal disturbances Metallic taste Both (a) & (b)	4(3.8%) 8(7.7%) 5(4.8%) 22(21.2%)	14(13.5%) 4(3.8%) 8(7.7%) 27(26.0%)	2(1.9%) 2(1.9%) 0(0.0%) 8(7.7%)	0.219	

**Discussion**

The current study evaluating dental students' awareness of probiotics revealed varying levels of knowledge across different academic years, with no significant differences in most areas. However, a few exceptions were observed, such as the recognition of probiotics' constituents, where significant differences were seen between groups, and perceptions of curriculum coverage, where CRRI students reported more extensive coverage than UG and PG students. Comparing these findings with other studies, it is evident that awareness of the term "probiotics" was much higher in several studies compared to the current one. For example, S Kamala Devi *et al.* found that 84.2% of respondents were aware of the term, Vidyalakshmi Santhanam *et al.* reported

77.4%, and Patait *et al.* showed 98% awareness, A study by Muchhal M 80.3% of undergraduates and 93% of postgraduates were aware of the term probiotics [7]. About 75% undergraduates and 93% postgraduate students agreed that probiotics are safe suggesting that general awareness of probiotics may be more widespread in other populations or studies. Similarly, while the current study found moderate awareness of probiotics' benefits for oral health (26% of CRRI, 36.5% of UG, and 10.6% of PG students), studies like S Kamala Devi *et al.* [8, 9] (75.2%) and Patait *et al.* (76.5%) Philip C *et al.* 66% awareness, also indicating a higher level than the current study's UG and PG students. reported much higher recognition, pointing to a better understanding of probiotics' potential in oral health among other populations.10

Regarding the identification of natural sources of probiotics, the current study saw low recognition, with only 24% of CRRI, 35.6% of UG, and 10.6% of PG students identifying sources like yogurt, cheese, and fermented rice-based foods. In contrast, S Kamala Devi *et al.* found that 76% of respondents were aware of milk and yogurt as sources, a figure significantly higher than those in the current study.<sup>9</sup> Tejaswi Kala *et al.* <sup>[10]</sup> also showed high awareness (83.2%) of probiotics but identified a gap in knowledge about their specific uses for conditions like halitosis and periodontitis. When assessing the recognition of probiotics' constituents, the current study revealed that only 24% of CRRI, 26.9% of UG, and 8.7% of PG students correctly identified live organisms as key constituents, with a significant p-value of 0.021, contrasting sharply with Patait *et al.*'s 94.1% correct identification <sup>[11]</sup>. This disparity emphasizes the need for more focused education on probiotics' composition in dental curricula. In terms of understanding probiotics' role in preventing dental caries, the current study showed that only a small percentage (17.3% of CRRI and UG students) recognized probiotics' role in reducing harmful Streptococcus species, which was lower than the awareness of probiotics' oral health benefits seen in other studies. Moreover, regarding curriculum coverage, the current study found that only 18.3% of CRRI, 16.3% of UG, and 6.7% of PG students perceived extensive coverage, which is in line with Vidyalakshmi Santhanam *et al.*'s call for more research and inclusion of probiotics in dental education.<sup>12</sup> Finally, barriers to using probiotics in dental practice, particularly issues of patient awareness, cost, and availability, were identified in the current study and were similarly noted in Gayathri Rajeev *et al.*'s work, where a significant majority (over 87%) expressed willingness to try probiotics, yet still faced challenges regarding these barriers.<sup>13</sup> These comparisons illustrate that while awareness and understanding of probiotics in dental education are relatively low, studies consistently point to gaps in education and the need for increased focus on probiotics in dental curricula.

## Conclusion

The current study reveals moderate awareness among dental students regarding probiotics, with significant gaps in knowledge about their benefits for oral health, sources, and constituents. Compared to other studies, the current study's awareness levels are relatively low. The differences could be attributed to variations in study population, educational exposure, and the scope of the curriculum in different dental colleges. Additionally, while awareness of probiotics' benefits for oral health is moderate, there is a significant need to improve the dental curriculum to address these knowledge gaps and overcome barriers to incorporating probiotics into dental practice.

## Conflict of Interest

Not available

## Financial Support

Not available

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