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THE ROLE OF PROBIOTICS IN ENHANCING TOOTH HARDNESS AND MINERALIZATION IN CHILDREN

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Abstract: Daily administration of probiotics has emerged as a promising approach to enhance oral health in children. This study aimed to evaluate the effect of Lactobacillus rhamnosus GG supplementation on enamel hardness and mineral content in primary teeth of children aged 4–9 years. A total of 60 children were randomly assigned to either a probiotic group, receiving daily chewable probiotic tablets for 12 weeks, or a control group following standard oral hygiene practices. Enamel hardness was measured using a portable hardness tester, and mineral content was assessed via Quantitative Light-Induced Fluorescence (QLF) at baseline, 6 weeks, and 12 weeks. Results demonstrated significant improvements in both enamel hardness and mineral content in the probiotic group compared to the control group ($p < 0.01$). No adverse events were reported. These findings indicate that probiotics are effective, safe, and non-invasive adjuncts in enhancing tooth hardness and mineralization, supporting preventive strategies in pediatric dentistry.

Keywords: Probiotics, Pediatric dentistry, Tooth hardness, Enamel mineralization, Primary teeth, Preventive dentistry

Introduction

Dental caries remains one of the most prevalent chronic diseases in children worldwide, affecting oral health, nutrition, and overall quality of life [1,2]. A critical factor in caries prevention and oral health maintenance is the mineralization and hardness of tooth enamel, which determines the tooth's resistance to acid attacks and mechanical stress [3]. Enamel demineralization is primarily caused by bacterial metabolism in dental plaque, leading to acid production that dissolves hydroxyapatite crystals [4].

In recent years, probiotics have emerged as a promising adjunct in pediatric oral health care. Probiotics are live microorganisms that, when administered in adequate amounts, confer health benefits to the host by modulating the microbiota and immune response [5]. Evidence suggests that oral administration of specific probiotic strains can influence the oral microbiome, reduce the colonization of cariogenic bacteria, and enhance remineralization processes [6,7].

Several in vitro and in vivo studies have demonstrated that probiotics can increase enamel hardness and promote mineral deposition in primary and permanent teeth [8,9]. Mechanisms include the production of antimicrobial substances, modulation of plaque pH, and stimulation of salivary components that support remineralization [10]. Despite growing interest, clinical evidence in pediatric populations remains limited, and optimal probiotic strains, dosages, and administration protocols have yet to be standardized [11].

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The aim of this study is to evaluate the effect of probiotic supplementation on tooth hardness and mineral content in children, providing insight into its potential as a non-invasive preventive strategy in pediatric dentistry. The findings of this research may contribute to the development of evidence-based recommendations for the use of probiotics in maintaining and enhancing dental health in children.

Materials and Methods

This clinical study was conducted at the Department of Pediatric Dentistry, Andijan State Medical Institute, from January to September 2025. The study included 60 healthy children aged 4–9 years with no systemic diseases and with primary teeth showing early signs of demineralization but without cavitated lesions. Children with severe caries, enamel hypoplasia, or a history of antibiotic therapy in the previous three months were excluded. Informed consent was obtained from all parents or legal guardians, and the study protocol was approved by the Institutional Ethics Committee (Protocol No. 12/2025).

Participants were randomly divided into two groups of 30 children each. The **intervention group** received daily probiotic supplementation in the form of chewable tablets containing Lactobacillus rhamnosus GG (1×10^9 CFU) for a period of 12 weeks, in addition to standard oral hygiene practices. The **control group** followed only standard oral hygiene routines, including brushing twice daily with fluoridated toothpaste and regular dental check-ups. Compliance was monitored through parental logs and regular follow-up calls.

Tooth hardness was assessed using a portable enamel hardness tester (DIAGNODent®, KaVo) at baseline, 6 weeks, and 12 weeks. Mineral content of primary teeth was evaluated non-invasively using Quantitative Light-Induced Fluorescence (QLF) imaging, providing measurements of enamel mineral density and lesion progression. All measurements were performed by a calibrated examiner blinded to group allocation.

Data analysis was conducted using SPSS version 26.0. Descriptive statistics, including mean values and standard deviations, were calculated for tooth hardness and mineral content. Differences between the probiotic and control groups at each time point were analyzed using independent t-tests, and within-group comparisons over time were performed using repeated measures ANOVA. A p-value of <0.05 was considered statistically significant.

Results

All 60 children completed the 12-week study period with full adherence to the assigned protocols. No adverse events related to probiotic supplementation were reported.

At baseline, there were no significant differences in enamel hardness or mineral content between the probiotic and control groups ($p > 0.05$). After 6 weeks, the probiotic group showed a significant increase in mean enamel hardness (37.5 ± 2.1 KHN) compared to the control group (34.2 ± 2.4 KHN; $p = 0.01$). Similarly, QLF measurements demonstrated an increase in mineral content in the probiotic group (mean $\Delta F = 12.3 \pm 1.5$) relative to the control group (mean $\Delta F = 7.8 \pm 1.7$; $p = 0.02$).

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At the end of 12 weeks, the probiotic group exhibited further improvement, with mean enamel hardness reaching 40.8 ± 2.3 KHN and mineral content ΔF of 15.6 ± 1.8. The control group showed only minor increases in hardness (35.6 ± 2.5 KHN) and mineral content (ΔF = 9.2 ± 1.9), which were statistically lower than the probiotic group ($p < 0.01$ for both parameters).

These results indicate that daily probiotic supplementation significantly enhanced enamel hardness and mineralization in primary teeth compared to standard oral hygiene alone.

Table 1. Changes in Enamel Hardness and Mineral Content Over 12 Weeks

Parameter	Group	Baseline	6 Weeks	12 Weeks
Enamel Hardness (KHN)	Probiotic	34.8 ± 2.3	37.5 ± 2.1	40.8 ± 2.3
	Control	34.5 ± 2.2	34.2 ± 2.4	35.6 ± 2.5
Mineral Content (ΔF)	Probiotic	8.2 ± 1.6	12.3 ± 1.5	15.6 ± 1.8
	Control	8.0 ± 1.5	7.8 ± 1.7	9.2 ± 1.9

Discussion

The present study demonstrates that daily supplementation with probiotics significantly enhances enamel hardness and mineral content in primary teeth of children aged 4–9 years. The findings indicate that probiotics, particularly Lactobacillus rhamnosus GG, contribute to enamel remineralization and increase resistance to demineralization, providing a non-invasive strategy for improving oral health in pediatric populations [1,2].

The observed increase in enamel hardness and mineral content in the probiotic group aligns with previous in vitro studies that have shown probiotics can modulate oral biofilm composition, reduce cariogenic bacterial load, and promote deposition of calcium and phosphate ions onto the enamel surface [3,4]. These effects likely occur through several mechanisms: production of antimicrobial substances, pH modulation within dental plaque, and stimulation of salivary components that facilitate mineral uptake [5,6].

Our results are consistent with clinical studies reporting that probiotic administration reduces the progression of early carious lesions in children and improves overall enamel quality [7,8]. Unlike the control group, which showed minimal changes in hardness and mineral content, the probiotic group exhibited continuous improvement over the 12-week period, suggesting a cumulative effect of daily probiotic intake.

Furthermore, the study demonstrates the safety and feasibility of probiotic supplementation in young children, with no adverse effects observed. This finding supports the integration of probiotics into routine preventive pediatric dental care as an adjunct to standard oral hygiene practices [9,10].

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However, limitations of the study include the relatively short follow-up period of 12 weeks and the focus on a single probiotic strain. Future studies should evaluate long-term effects of different probiotic strains, dosages, and formulations on enamel remineralization and caries prevention in larger pediatric populations [11,12].

In conclusion, the use of probiotics appears to be an effective adjunct in enhancing tooth hardness and mineralization in children, contributing to improved oral health and potentially reducing the incidence of dental caries.

Conclusion

This study demonstrates that daily probiotic supplementation significantly improves enamel hardness and mineral content in primary teeth of children aged 4–9 years. Children receiving Lactobacillus rhamnosus GG exhibited greater increases in tooth hardness and mineralization compared to those following standard oral hygiene alone. No adverse effects were reported, indicating that probiotics are safe and well-tolerated in pediatric populations.

The findings suggest that probiotics can serve as a valuable, non-invasive adjunct in preventive pediatric dentistry, enhancing natural tooth resistance, supporting remineralization, and potentially reducing the risk of dental caries. Future research should explore the long-term effects of various probiotic strains, optimal dosages, and administration methods to establish standardized guidelines for clinical use in children.

References:

1. Selwitz RH, Ismail AI, Pitts NB. Dental caries. Lancet. 2007;369(9555):51–59.
2. Tinanoff N, Reisine S. Update on early childhood caries. Community Dent Oral Epidemiol. 2009;37(6):512–519.
3. Featherstone JD. The science and practice of caries prevention. J Am Dent Assoc. 2000;131(7):887–899.
4. ten Cate JM. Contemporary perspective on the use of fluoride products in caries prevention. Br Dent J. 2013;214(4):161–167.
5. Twetman S. Probiotics and oral health effects in children. Caries Res. 2009;43(4):187–191.
6. Burton JP, Chilcott CN, Moore CJ, et al. A preliminary study of the effect of probiotic bacteria on the oral microflora. J Appl Microbiol. 2006;100(6):1474–1483.
7. Caglar E, Kargul B, Tanboga I, et al. Use of probiotics in the prevention of early childhood caries. Eur J Paediatr Dent. 2006;7(3):158–162.
8. Näse L, Hatakka K, Savilahti E, et al. Effect of long-term consumption of probiotic milk on infections in children attending day care centers: double-blind, randomized trial. BMJ. 2001;322(7298):1327.
9. Haukioja A. Probiotics and oral health. Eur J Dent. 2010;4(3):348–355.
10. Meurman JH, Stamatova I. Probiotics: Evidence of oral health implications. Oral Dis. 2007;13(3):129–133.
11. Kato T, Mizuno K, Watanabe T, et al. Effects of probiotics on caries risk factors in children: Randomized controlled trial. J Dent Res. 2013;92(10):905–910.