Journal of Pioneering Medical Sciences
Received October 10, 2023 Accept December 4, 2023 Publish December 11, 2023.
Volume 12, Issue 2, Pages 16-19

DOI https://doi.org/10.61091/jpms20231224

Estimation of Buffering Capacity of Saliva Among 17-21 Years Old Population After Probiotic Yogurt Consumption - A Clinical Trial

Rithanya. M.[1], Jayashri Prabakar[2,*] and Jishnu Krishna Kumar[2]
[1]Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Tamil Nadu 600077, India.
[2]Department of Public Health Dentistry Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Tamil Nadu 600077, India.

Corresponding author: Jayashri Prabakar (e-mail: jayashri.sdc@saveetha.com).

Abstract The buffering capacity of saliva is a crucial function that serves multiple purposes. The normal pH of saliva is 6.3, and the buffering capacity of saliva maintains it above 5.5, thereby preventing demineralization. In this study, we evaluate the buffering capacity of saliva post-consumption of normal and probiotic yogurt. Therefore, the study's objective was to estimate saliva's buffering capacity among the 17-21-year-old population post-probiotic yogurt and regular yogurt consumption. The buffering capacity of saliva was tested using the Ericsson method (1959), where 0.5 mL of saliva was mixed with 1.5 mL of 5 mmol/L HCl. The mixture was mixed aggressively, centrifuged for a minute, and allowed to stand for 10 minutes. The baseline mean salivary buffering capacity of plain yogurt was 5.70 ± 0.42, and after 15 days, it decreased to 4.50 ± 0.70, then it gradually increased to 5.35 ± 0.77 after 30 days of follow-up. The baseline mean salivary buffering capacity of probiotic yogurt was 2.90 ± 0.42, and after 15 days, it increased to 4.05 ± 0.21 then it increased further to 5.10 ± 0.28 after 30 days of follow-up. Probiotic yogurt reduces the incidence of dental caries by preventing demineralization of the enamel surface caused by reduced pH levels (acidic pH). However, it is seen that the buffering capacity of saliva does not significantly increase after the consumption of probiotic yogurt as compared to regular yogurt.

Key Words Buffering capacity, Saliva, Probiotics, Probiotic Yogurt, Dental Caries

1. Introduction

Probiotics are live microorganisms, predominantly bacteria and sometimes yeast, which are beneficial to human health when taken in requisite amounts [1]. These microorganisms are most commonly called the "good" or "friendly" bacteria because they can have positive effects on our digestive system and overall well-being [2]. Probiotics encompass various strains of bacteria and yeast, with the most common types being Lactobacillus and Bifidobacterium [3]. Each strain may offer different health benefits such as aiding in digestive health, immune support, vaginal health, preventing and alleviating various digestive issues [4].

Probiotic microorganisms are naturally found in our digestive system and play a crucial role in maintaining a balanced gut microbiome, which is necessary for overall health [5]. They promote digestive health by helping to break down food, absorb nutrients and prevent the overgrowth of harmful bacteria in the gut. They maintain a harmonious balance between beneficial and harmful microorganisms and promote overall well-being [6]. They are also known for strengthening the immune system by supporting the gut's barrier function, reducing inflammation, and enhancing antibody production [7].

Saliva, which is produced by salivary glands in the mouth, performs a vital role in maintaining oral health and aiding in the digestion process [8]. One of its key properties is its buffering capacity, which refers to its ability to resist changes in pH levels when acidic or basic substances are introduced7. This buffering capacity is essential for various reasons [9]. Saliva's buffering capacity primarily stems from the presence of bicarbonate ions (HCO_3^-) and other chemical components [10]. These bicarbonate ions can neutralize excess acids, aiding in maintaining a relatively stable pH environment in the mouth [11]. When we consume acidic foods or drinks, saliva immediately starts working to counteract the acidity, preventing damage to tooth enamel and the delicate tissues of the mouth [12].

The buffering capacity of saliva is vital for dental health. Tooth enamel is vulnerable to erosion by acids, such as those found in soft drinks and citrus fruits [13]. Saliva helps protect teeth by neutralizing these acids, preventing tooth decay and cavities [14]. It also promotes remineralization, where essential minerals like calcium and phosphate are deposited back into the enamel, strengthening it [15].

Furthermore, saliva's buffering capacity aids in maintaining a comfortable oral environment [16]. It helps prevent the development of conditions like dry mouth (xerostomia), which causes uneasiness, strenuousness in chewing and swallowing, and an heightened possibility of dental problems [17]. In cases of dry mouth, the lack of adequate saliva reduces the mouth's ability to neutralize acids, leaving teeth and tissues vulnerable to damage [18].

Beyond dental health, saliva's buffering capacity contributes to efficient digestion. It begins the digestive process by breaking down starches through the enzyme amylase, which functions optimally at a slightly acidic pH [19]. Saliva helps maintain this pH level, ensuring the enzyme's effectiveness in breaking down carbohydrates before they reach the stomach [20].

The buffering capacity of saliva is a crucial function that serves multiple purposes. It protects teeth from acid erosion, promotes remineralization, maintains oral comfort, and aids in the initial stages of digestion [21]. Without this buffering capacity, our oral health and digestive processes would be compromised, underlining the importance of saliva in maintaining overall well-being [22].

The buffering capacity of saliva remains one among the important factors bestowing to progression of dental caries. Normal pH of saliva is 6.3 and buffering capacity of saliva maintains it above 5.5, thereby preventing demineralisation [23]. In this study, we estimate the buffering capacity of saliva post consumption of normal and probiotic yogurt.

2. Materials And Methods

The present invivo study was conducted among 40 healthy dental caries-free people between the age group of 17-21 years from the college of Saveetha Dental College were randomly divided into 2 groups based on the yogurt prescribed: Plain Yogurt (Group 1) as a control group and Probiotic yogurt (Group 2) as a test group (refer Figure 1).

Computer generated random numbers were followed for random sequence generation of the participants. A baseline unstimulated whole saliva sample (2mL) was collected in the morning by asking the patient to drool passively into a sterile test tube for 5 minutes. The participants were informed not to eat or drink except water 1 hour before saliva collection in order to reduce possible food debris and saliva stimulation. The samples collected in sterile test tubes were carried in the icebox containing ice used as transport media.

The buffering capacity of saliva was assessed. The adults were advised to consume 200mL of regular curd (control group) and 200mL of probiotic yogurt (test group) each day for 30 days under the supervision of two investigators.

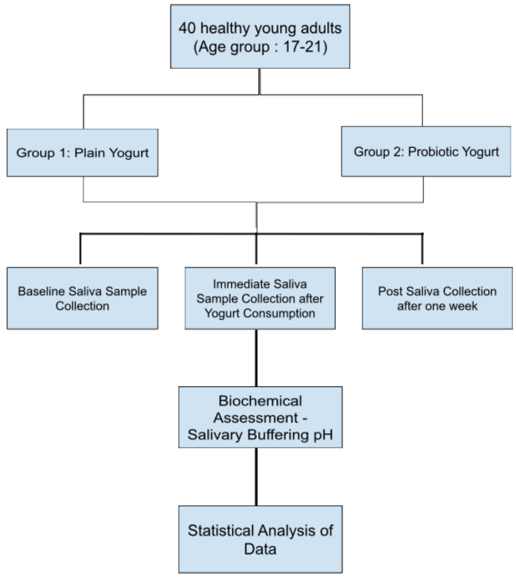

Figure 1: Methodology for assessing buffering capacity of saliva post consumption of regular yogurt and probiotic yogurt

Figure 2: Saliva sample collection

Saliva sample was taken on the 15th day and at the end of 30 days using the same procedure and the buffering capacity of saliva was tested (Figure 2).

The buffering capacity of saliva was tested using the Ericsson method (1959) [24] where 0.5 mL of saliva was mixed with 1.5 mL of 5 mmol/L HCl. The mixture was shaken vigorously, subjected to centrifugation for a minute, and allowed to stand for 10 minutes (Figure 3).

3. Results

The baseline mean salivary buffering capacity of plain yogurt was 5.70 ± 0.42, and after 15 days, it decreased to 4.50 ± 0.70,

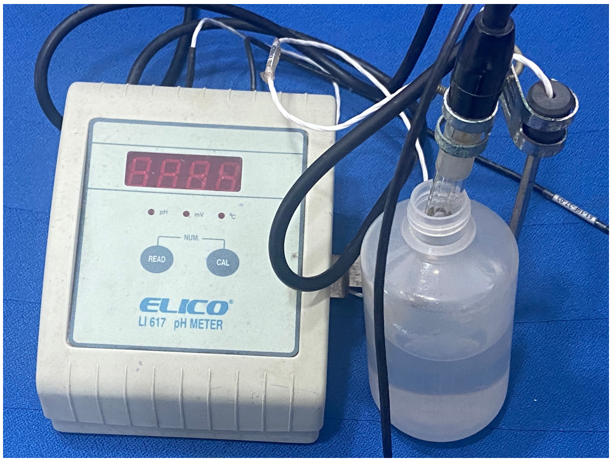

Figure 3: Buffering capacity estimator

Groups	Baseline	15 days	30days
1 (Plain Yogurt)	5.70±0.42	4.50±0.70	5.35±0.77
2 (Probiotic yogurt)	5.75± 0.52	4.05±0.21	5.10±0.28

Table 1: Mean Salivary buffering capacity at different time periods for Group I and II

then it gradually increased to 5.35±0.77 after 30 days of follow-up. The baseline mean salivary buffering capacity of probiotic yogurt was 2.90± 0.42, and after 15 days, it increased to 4.05±0.21 then it increased further to 5.10±0.28 after 30 days of follow-up (Table 1). Table 2 compares the mean buffering capacity between Groups I and II at different periods. A statistically significant difference was not observed between groups using the Mann-Whitney U test. Table 3 depicts the comparison of the mean buffering capacity of Groups I and II between different periods. Using the Friedmann test, no significant difference was found.

Between Groups	Baseline Group I, II	15 days Group I, II	30 daysGroup I, II
Mann whitney U test value	2.10	2.09	3.07
P value	0.09	0.06	0.07

Table 2: Comparison of mean buffering capacity at different time periods between Group I and II

Within Groups	Group I Baseline, 15 and 30 days	Group II Baseline, 15 and 30 days
Friedmann test value	4.02	0.08
P value	3.09	0.07

Table 3: Comparison of mean buffering capacity of Group I and II between different time periods

4. Discussion

Probiotics can influence salivary buffering capacity by promoting a healthier oral microbiome. They may help maintain a balanced population of beneficial bacteria in the mouth, contributing to better saliva composition and function. However, the exact mechanisms and effectiveness can vary based on the specific probiotic strains and individual factors.

The buffering capacity of saliva post consumption of sugary, sugar-free, and probiotic chewing gums was studied [25], in which participants were asked to chew the three different kinds of chewing gums (ones that contained sugar, sugar-free, and probiotic). Then, the buffering capacity was estimated using ANOVA and Tukey's test. From the results, this study concluded that probiotic chewing gum had no cariogenic potential in that study population. This supports our study that there is no significant association between an increase in the buffering capacity of saliva and the consumption of probiotic yogurt.

In a study [26], the salivary flow rate, buffering capacity of saliva, and the level of S.mutans and lactobacillus were analyzed in orthodontic patients grouped as participants who had probiotic treatment and who had not with the help of chair side kits. A significant increase in salivary buffering capacity was observed in participants who had probiotic treatment. This is in contrast with our study, where no significant increase in the buffering capacity of saliva is observed in the consumption of probiotic yogurt.

In a triple-blinded, placebo-controlled, randomized trial [27]. The buffering capacity of saliva along with levels of S.mutans, Lactobacillus among 3-4 year children who were supplemented with milk-containing probiotic bacteria and standard milk for nine months was analyzed. This trial revealed that the consumption of probiotic milk over nine months did not show an increased buffering capacity of saliva compared to standard milk. This is also by our study.

5. Clinical Significance

Probiotics are highly nutritious fermented food considered to be a part of the South Indian diet [24]. It has been reported that orally administered probiotics demonstrate increased immune responses [28]–[31] and administered in sufficient amounts confer a health benefit as well [32]–[37]. Salivary pH [33] and buffering capacity play a vital role in oral health maintenance. A decrease in salivary pH can lead to an acidogenic environment, resulting in dental caries. Hence, the oral administration of probiotics can maintain the salivary pH and buffering capacity, promoting better oral health.

6. Conclusion

Probiotic yogurt reduces the incidence of dental caries by preventing demineralization of the enamel surface caused by reduced pH levels (acidic pH). However, it is seen that the buffering capacity of saliva does not significantly increase after probiotic yogurt consumption compared to regular yogurt in the current study.

Conflict of Interest

The authors declare no conflict of interests. All authors read and approved final version of the paper.

Authors Contribution

All authors contributed equally in this paper.

References

[1] Bistas, K. G., & Tabet, J. P. (2023). The Benefits of Prebiotics and Probiotics on Mental Health. Cureus, 15(8), e43217.

[2] Dwivedi, M. K., Amaresan, N., Sankaranaryanan, A., & Kemp, H. (2021). Probiotics in The Prevention and Management of Human Diseases: A Scientific Perspective. Academic Press.

[3] Krishnan, L., Poorni, S., Nivedhitha, M. S., & Srinivasan, M. R. (2022). Knowledge, Attitude, and Practice of Probiotics for Oral Health among Dental Students: A Cross-Sectional Study. Journal of Indian Association of Public Health Dentistry, 20(3), 230-233.

[4] Hattner, J. A., Anderes, S., & Saavedra, J. M. (2009). Gut Insight: Probiotics and Prebiotics for Digestive Health and Well-Being by Jo Ann Hattner, MPH, RD, With Susan Anderes, MLIS• Published by the author• 2009• 126 pages• $12.95• ISBN: 978-0-615-28524-5• Available at www. gutinsight. com. ICAN: Infant, Child, & Adolescent Nutrition, 1(6), 351-351.

[5] Soccol, C. R., de Souza Vandenberghe, L. P., Spier, M. R., Medeiros, A. P., Yamaguishi, C. T., De Dea Lindner, J., ... & Thomaz-Soccol, V. (2010). The potential of probiotics: a review. Food Technology and Biotechnology, 48(4), 413-434.

[6] Ziqi Liu, Tiancheng Sun, Yiyin Chen, Xiaoyi Mo, Hsiaohan Kao and Hui-Jiuan Chen Journal: ACS Biomaterials Science & Engineering, 2023,DOI: 10.1021/acsbiomaterials.3c00029

[7] Balaganesh, S., Balasubramaniam, A., Indiran, M. A., Rathinavelu, P. K., & Kumar, M. P. S. (2022). Determination of salivary cortisol and salivary pH level in gaming teenagers - A cross-sectional study. Journal of Oral Biology and Craniofacial Research, 12(6), 838-842.

[8] Dreizen, S., & Mann, A. W. (1946). The buffer capacity of saliva as a measure of dental caries activity. Journal of Alabama Academy of Science, 18, 68.

[9] Leung, S. W. (1951). A demonstration of the importance of bicarbonate as a salivary buffer. Journal of Dental Research, 30(3), 403-414.

[10] [No author]. (Year, Month Day). [No title]. Retrieved from URL

[11] Prakash, A. R., Nahar, P., Ashtekar, M., Natarajan, S., Singh, R., & Kulkarni, G. (2020). Detection of salivary alkaline phosphatase levels in smokers, diabetic patients, potentially malignant diseases and oral malignant tumours. Journal of Pharmacy & Bioallied Sciences, 12(Suppl 1), S430-S435.

[12] Zhang, D., Jiang, H., Chen, J., & Wang, X. (2022). Buffering capacity of saliva influences the perception of acid-related sensory properties. Food Quality and Preference, 97, 104454.

[13] Lakshmi Bolla, V., Munnangi, S. R., Chowdary, U. K., Koppulu, P., & Swapna, L. A. (2017). Correlation between the pH of saliva, plaque and buffering capacity of saliva. International Journal of Applied Dental Sciences, 53, 48-50.

[14] Preethi, B. P., Reshma, D., & Anand, P. (2010). Evaluation of flow rate, pH, buffering capacity, calcium, total proteins and total antioxidant capacity levels of saliva in caries free and caries active children: An in vivo study. Indian Journal of Clinical Biochemistry, 25(4), 425-428.

[15] Chellappa, L.R., Doraikannan, S. and Indiran, M.A., 2021. Assessment Of Probiotic Activity and Anti-Oxidant Potential Of Commercially Available Probiotic Chocolate In India. Int J Dentistry Oral Sci, 8(9), pp.4393-4398.

[16] Prabhakar, A., Dodawad, R., & Os, R. (2009). Evaluation of flow rate, pH, buffering capacity, calcium, total protein and total antioxidant levels of saliva in caries free and caries active children - an in vivo study. International Journal of Clinical Pediatric Dentistry, 2(1), 9-12.

[17] Moritsuka, M., Kitasako, Y., Burrow, M. F., Ikeda, M., Tagami, J., & Nomura, S. (2006). Quantitative assessment for stimulated saliva flow rate and buffering capacity in relation to different ages. Journal of Dentistry, 34(9), 716-720.

[18] Balaganesh, S., Kumar, P., Girija, A. S. S., & Rathinavelu, P. K. (2022). Probiotic curd as antibacterial agent against pathogens causing oral deformities - in vitro microbiological study. Journal of Advanced Pharmaceutical Technology & Research, 13(Suppl 2), S510-S513.

[19] Bassoukou, Bassoukou, I.H., Nicolau, J. and Dos Santos, M.T., 2009. Saliva flow rate, buffer capacity, and pH of autistic individuals. Clinical Oral Investigations, 13, 23-27.

[20] Ericsson, Y. (1959). Clinical Investigations of the Salivary Buffering Action. Acta Odontologica Scandinavica, 17(2), 131-165.

[21] Antunes, D.P., de Melo Marinho, R.M., Garakis, M.C.V. and Bresciani, E., 2015. Buffer capacity of saliva as a function of time after consumption of sugary, sugar-free and probiotic chewing gums. Pesquisa Brasileira em Odontopediatria e ClÃnica Integrada, 15(1), 153,161.

[22] Alp, S., & Baka, Z. M. (2018). Effects of probiotics on salivary Streptococcus mutans and Lactobacillus levels in orthodontic patients. American Journal of Orthodontics and Dentofacial Orthopedics, 154(4), 517-523.

[23] Villavicencio, J., Villegas, L. M., Arango, M. C., Arias, S., & Triana, F. (2018). Effects of a food enriched with probiotics on Streptococcus mutans and Lactobacillus spp. salivary counts in preschool children: a cluster randomized trial. Journal of Applied Oral Science, 26, e20170318.

[24] Safeena Beevi, S. S., Biju Pottakkat, & Sankar Narayanan. (2023). Role of Probiotics and Gut microbiota in Liver Diseases. Asian Journal of Nursing Education and Research, 13(2), 157-171.

[25] Lokhande, S., More, S., & Raje, V. (2018). A systematic study of probiotics-an update review. Asian Journal of Pharmacy and Technology, 8(3), 149-157.

[26] Hanifa Nurrosyidah, I., Mertaniasih, N. M., & Isnaeni, I. (2022). Antibacterial activity of probiotics cell-free fermentation filtrate from Passiflora edulis Sims against pathogen bacteria. Research Journal of Pharmacy and Technology, 15(12), 5767-5773.

[27] Mancin, S., & Mazzoleni, B. (2023). Probiotics as adjuvant therapy in the treatment of allergic rhinitis. Research Journal of Pharmacy and Technology, 16(5), 2393-2398.

[28] Chauhan, A., Kaur, S., & Singh, R. (2018). A review on probiotics and fish farming. Research Journal of Pharmacy and Technology, 11(11), 5143-5146.

[29] Abraham, N., Namachivayam, C., & Sundaramoorthy, S. (2021). Lactobacillus - A friendly bacteria. International Journal of Technology, 11(2), 70-77.

[30] Zam, W., & Dawod, R. (2020). Overview of the probiotics' role in gastrointestinal disorders. Research Journal of Pharmacy and Technology, 13(11), 5557-5561.

[31] Dewi, N. P., Poddar, S., Rai, R. P., Purwati, E., Abdullah, D., & Pratama, Y. E. (2023). The potential lactic acid bacteria from Dadiah Sianok Bukittinggi City, West Sumatera as probiotic. Research Journal of Pharmacy and Technology, 16(2), 627-634.

[32] Ramadhani, P., Suharjono, Saputro, I. D., Arfiani, R. F., & Nosa, U. S. (2023). Scoping review: Effects of probiotics against the immune system in burn patients. Research Journal of Pharmacy and Technology, 16(1), 345-353.

[33] Pratha, A. A., & Prabakar, J. (2019). Comparing the effect of carbonated and energy drinks on salivary pH - In vivo randomized controlled trial. Research Journal of Pharmacy and Technology, 12(10), 4699-4702.

[34] MA, S., G, M., M, R., & J, S. (2023). Dental caries as a source of Helicobacter pylori infection in children: An RT-PCR study. International Journal of Paediatric Dentistry, 33(1), 82-88.

[35] Balaganesh, S., Kumar, P., Girija, A. S., & Rathinavelu, P. K. (2022). Probiotic curd as an antibacterial agent against pathogens causing oral deformities - An in vitro microbiological study. Journal of Advanced Pharmaceutical Technology & Research, 13(Suppl 2), S510-S513.

[36] Sneka, S., & Sinduja, P. (2022). A comparative study on salivary pH in diabetic patients with periodontitis and without periodontitis. Journal of Pharmaceutical Negative Results, 4, 1253-1258.

[37] Chellappa, L. R., Leelavathi, L., Indiran, M. A., & Rathinavelu, P. K. (2021). Prevalence and dependency of tobacco use among tribal gypsies in Thoothukudi district - A cross-sectional study. Journal of Family Medicine and Primary Care, 10(2), 738-744.