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Research Article

Comparative Evaluation of Commercially available different Candies on Salivary pH among Young Adults- A Randomised Control Trial.

Dr. Snehal Chintale [1]*, Dr. Arun Dodamani[2], Dr. Ashwini Zadode[3], Dr. Sharvari Tadas[4], Dr. Sujata Chhabile[5]

1,4,5. Post Graduate, Department of public health Dentistry, Jawahar Medical Foundation's Annasaheb Chudaman Patil Memorial Dental College, Dhule, INDIA.

2. HOD and Professor, Department of public health Dentistry, Jawahar Medical Foundation's Annasaheb Chudaman Patil Memorial Dental College, Dhule, INDIA.

3. Post Graduate, Department of Periodontics, Jawahar Medical Foundation's Annasaheb Chudaman Patil Memorial Dental College, Dhule, INDIA.

***Correspondence to**: Dr. Snehal Chintale, Post Graduate, Department of public health Dentistry, Jawahar Medical Foundation's Annasaheb Chudaman Patil Memorial Dental College, Dhule, INDIA.

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ABSTRACT

Introduction *Diet refers to the total amount of food consumed by individuals. Oral health has often been viewed in isolation from the general health. In earlier times, dental care was mainly directed toward repairing damage caused by oral diseases.". This study is the aims of assessing the effect of selected available beverages on salivary pH amongst young adults.*

Materials and Method- *This clinical trial included 25 participants, divided into five distinct groups. The test candies consisted of sugary candies, Hajmola candies, coffee candies, imli candies, and Aawala candies. Statistical analysis was conducted using SPSS, employing descriptive statistics, one-way ANOVA, and post hoc Tukey's test.*

Results- *After the consumption of candies across all the group, there was an immediate decrease in the salivary Ph followed by it was increases at 10 and 30 minutes interval. It was shown that salivary pH decrease for all the beverages immediately after consumption.*

Conclusion- *This study is to find out that candies will clears rapidly from the oral cavity, and also address the future complication and to increase the awareness among the young adults. they have a significant cariogenic and erosive potential. Hence, it is always advised to minimise the consumption of candies, especially amongst children and young adults to maintain a good oral health.*

Keywords- *Dental caries, sugary beverages, salivary pH, cariogenic, candy.*

Introduction

Health can be viewed as the presence or absence of disease or medically measured risk factors in an individual. However, more broadly, health is 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (WHO 1946). In the context of health, integrity signifies honesty, ethical conduct, and adherence to strong moral principles by individuals and organizations involved in healthcare delivery and research. (1)

Oral health is the state of the mouth, teeth and orofacial structures that enables individuals to perform essential functions such as eating, breathing and speaking, and encompasses psychosocial dimensions such as self-confidence, well-being and the ability to socialize and work without pain, discomfort and embarrassment. Oral health conditions are largely preventable and can be treated in their early stages. Most cases are dental caries (tooth decay), periodontal diseases, tooth loss and oral cancers. Other oral conditions of public health importance are orofacial clefts, noma (severe gangrenous disease starting in the mouth mostly affecting

children) and oro-dental trauma.[2]

The WHO Global Oral Health status Report (2022) estimated that oral diseases affect close to 3.5 billion people worldwide, with 3 out of 4 people affected living in middle-income countries. Globally, an estimated 2 billion people suffer from caries of permanent teeth and 514 million children suffer from caries of primary teeth. Prevalence of the main oral diseases continues to increase globally with growing urbanization and changes in living conditions.

Oral health has traditionally been considered separate from overall health, with dental professionals primarily concentrating on treating oral diseases. However, contemporary dentistry now prioritizes disease prevention and acknowledges the critical connection between the health of the teeth and oral tissues and the body's overall well-being.[2] Diet plays a significant role in the development of dental caries and enamel erosion. A person's nutritional health affects both the formation of teeth and their ability to resist various oral conditions, such as periodontal disease and oral cancer.[3] Saliva is crucial for maintaining oral health and serves as a key diagnostic biofluid. It plays an important role in protecting and lubricating oral tissues, aiding in the remineralization of teeth, and assisting with digestion.[4] The unique composition of saliva provides it with various physical and biochemical properties, making it valuable for diagnosing, predicting, and managing both oral and systemic conditions.[5] Human saliva is made up of 99% water, along with glycoproteins, mucous epithelial cells, and enzymes like amylase and lipase (Carpenter, 2013).[6] pH, which measures the acidity or alkalinity of a solution, indicates the concentration of hydrogen ions in that solution. A solution with a high concentration of hydrogen ions has a low pH, while one with fewer hydrogen ions has a high pH. The pH of saliva plays a crucial role in the balance between the acidic demineralization of teeth and the remineralization of early caries lesions.[7] After consuming fermentable carbohydrates, especially sugars, bacteria in the plaque produce acids that lower the pH. Conversely, the pH rises when these acids are neutralized or washed away by saliva, which contains bicarbonate, an important buffer (Dawes et al., 2015).[4] As the sucrose content rises, salivary fermentation intensifies, leading to increased microbial acidity and a higher risk of enamel dissolution and potential caries formation.[8] Biscuits, soft drinks, and breakfast cereals are among the most common sources of dietary sugars.[5] Saliva typically has a pH between 6.7 and 7.4, but bacterial breakdown of carbohydrates produces lactic, butyric, and aspartic acids, lowering the pH. When the pH in the mouth drops below the critical threshold of 5.5, these acids start eroding tooth enamel. Prolonged exposure to low salivary pH increases the risk of developing dental caries.[9] Dental caries, despite being largely preventable, continues to be the most widespread chronic disease affecting both children and adults. [10].Individuals aged 15 to 28 are particularly vulnerable. In today's era, the frequent consumption of junk food and snacking between meals is notably common among younger individuals and their peers [2] Therefore, this study was conducted to evaluate the impact of selected locally available candies on salivary pH in young adults.

Materials and Method

The study was a randomised, double blind, controlled, parallel group design clinical trial. Conducted at department of Public health dentistry at the dental college. Prior to the start of the study, the study protocol was approved by the institutional ethical committee. (/EC/NEW/INST/2022/2959/2022/081). A total of 25 undergraduate students, randomly selected from the dental college were examined and selected.19 All study participants shared similarities in age, oral hygiene practices, and other lifestyle factors that could significantly influence the study outcomes. Prior to the start of the study, each participant was informed about purpose of the study. Consent was obtained from all subjects after providing a detailed explanation. The subjects were chosen based on specific criteria, including: being 15 to 28 years old, having a DMFT score of zero (indicating they were caries-free), and being free from any systemic disease or illness. The subjects consumed a single candy, and stimulated saliva samples were collected at predetermined intervals: (i) immediately after consumption, (ii) 5 minutes post-consumption, (iii) 10 minutes post-consumption, and (iv) 15 minutes post-consumption. The study participants consumed four different candies on seperate days, with salivary samples collected accordingly. The participants divided into five groups, sugary candies, Hajmola candies, coffee candies, imli candies, Aawala candies. The intrinsic pH of each beverage was measured prior to the study.

Figure 1. Vanira LI 613 digital pH meter

Figure 2. Saliva with distilled water

Unstimulated saliva samples were collected with participants seated comfortably on a standard chair. Samples were obtained at baseline and at each time point after beverage consumption for up to one minute. Salivary pH was measured directly using Vanira LI613 digital pH meter. The meter's accuracy was regularly verified to ensure reliable readings. A pH-sensitive glass combination electrode was immersed in the collected saliva sample. The digital reading was monitored until it stabilized, and the pH value was then recorded. Between measurements, the electrode was rinsed thoroughly with distilled water and immersed in a standard pH 7 solution to maintain stability and monitor potential drift. Saliva pH was assessed promptly, within 10 minutes of sample collection. A p value of ≤0.05 was considered significant for all statistical analyse.

Sample collection. A p value of ≤0.05 was considered significant for all statistical analyse.

Results

Table 1. Comparison of change in salivary pH within each group

Group	Before		5mins		15mins		30mins		p-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Group 1	4.42	0.88	4.26	0.74	5.83	0.70	6.56	0.36	<0.001*
Group 2	3.93	0.49	4.10	0.62	5.36	0.46	6.42	0.95	<0.001*
Group 3	4.16	0.38	4.35	0.68	3.96	0.32	4.50	0.45	0.325
Group 4	4.10	0.41	3.66	0.33	4.69	0.42	5.06	1.00	0.002*
Group 5	4.02	0.45	3.46	0.37	4.28	0.42	5.19	0.55	<0.001*

Repeated measures ANOVA test; * indicates a significant difference at p≤0.05

Intra-group comparisons (Table 1) revealed that Groups 1, 4, and 5 exhibited an initial decrease in salivary

pH at 5 minutes post-intervention, followed by a progressive increase up to 30 minutes. This biphasic pattern suggests an immediate acidogenic response followed by salivary buffering. Group 2 demonstrated a continuous rise in pH from baseline to 30 minutes, potentially reflecting a higher buffering capacity or reduced acidogenic potential. Notably, all groups except Group 3 demonstrated statistically significant changes over time.

Table 2.Pairwise comparison of change in salivary pH within each group

Group	B vs 5	B vs 15	B vs 30	5 vs 15	5 vs 30	15 vs 30
Group 1	1.000	0.396	0.058	0.116	0.011*	0.069
Group 2	1.000	0.011*	0.044*	0.031*	0.069	0.826
Group 3	1.000	0.876	1.000	1.000	1.000	0.660
Group 4	0.600	0.470	0.675	0.001*	0.071	1.000
Group 5	0.391	0.486	0.004*	0.168	0.013*	0.006*

Post hoc Bonferroni test; * indicates a significant difference at p≤0.05

Table 3. Intergroup comparison of salivary pH

Interval	Group 1		Group 2		Group 3		Group 4		Group 5		p-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Before	4.42	0.88	3.93	0.49	4.16	0.38	4.10	0.41	4.02	0.45	0.686
5mins	4.26	0.74	4.10	0.62	4.35	0.68	3.66	0.33	3.46	0.37	0.094
15mins	5.83	0.70	5.36	0.46	3.96	0.32	4.69	0.42	4.28	0.42	<0.001*
30mins	6.56	0.36	6.42	0.95	4.50	0.45	5.06	1.00	5.19	0.55	<0.001*

One-way ANOVA test; * indicates a significant difference at p≤0.05

Inter-group analysis (Tables 2 and 3) indicated that there was no significant difference in salivary pH among the groups at baseline and at 5 minutes post-intervention. However, by 15 minutes, a significant divergence was observed, with Group 1 exhibiting the highest pH and Group 3 the lowest. This pattern persisted at 30 minutes, suggesting that Group 1 benefited from a more robust salivary recovery response, while Group 3 remained in an acidic environment for a prolonged duration, potentially increasing caries risk.

Table 4. Pairwise comparison of salivary pH between five groups

Pair	Before	5mins	15mins	30mins
Gr 1 vs Gr 2	0.628	0.991	0.537	0.997
Gr 1 vs Gr 3	0.947	0.999	<0.001*	0.001*

Gr 1 vs Gr 4	0.893	0.476	0.010*	0.024*
Gr 1 vs Gr 5	0.780	0.212	<0.001*	0.044*
Gr 2 vs Gr 3	0.958	0.957	0.001*	0.003*
Gr 2 vs Gr 4	0.985	0.745	0.225	0.048*
Gr 2 vs Gr 5	0.999	0.417	0.016*	0.084
Gr 3 vs Gr 4	1.000	0.350	0.153	0.717
Gr 3 vs Gr 5	0.993	0.141	0.824	0.550
Gr 4 vs Gr 5	0.999	0.980	0.664	0.999

Post hoc Tukey test; * indicates a significant difference at $p \leq 0.05$

Discussion

The present study assessed salivary pH variations across five distinct groups and revealed clinically significant changes. Saliva plays a vital role in the maintenance of oral health, primarily through its buffering capacity and ability to neutralize acids. However, salivary pH is subject to fluctuations influenced by several intrinsic and extrinsic factors, including smoking, systemic diseases such as diabetes, and dietary habits—particularly the frequent consumption of acidic foods and beverages such as soft drinks and citrus fruits [9].

Saliva plays an essential role in maintaining oral homeostasis by regulating the pH within a physiological range of 6.2 to 7.6, with a mean value of approximately 6.7. Under resting conditions, salivary pH generally does not decline below 6.3. The oral cavity is maintained in a near-neutral environment (pH 6.7–7.3) predominantly through salivary mechanisms. This pH regulation occurs via two principal pathways, salivary flow facilitates the clearance of the removal of organic acids generated by microbial metabolism; and the buffering capacity of saliva effectively neutralizes exogenous and endogenous acids derived from dietary sources and bacterial activity. (8)

According to Rinki hans et al, frequent and prolonged intake of acidogenic beverages can cause recurring drops in plaque pH, potentially resulting in demineralization . Nonetheless, several host factors—such as salivary flow rate, buffering capacity, salivary pH,—play a crucial role in modulating the severity of dental erosion. However, this study revealed that Groups 1, 4, and 5 exhibited an initial decrease in salivary pH at 5 minutes post-intervention, followed by a progressive increase up to 30 minutes.

The findings of this study are in concordance with those reported by Ankit Pachori et al., who highlighted the critical role of sugary products exposure in caries activity. The microbial biofilm adherent to tooth surfaces metabolizes—namely fructose, and sucrose—via glycolytic pathways, leading to the production of organic acids as metabolic by-products. These acids contribute to a localized drop in pH, fostering an environment conducive to enamel demineralization and dental caries development, However, by 15 minutes, a significant

divergence was observed, with Group 1, sugary candies exhibiting the highest pH [5].

The literature supports the observed influence of dietary components on salivary pH. Frequent intake of sugars between meals, coupled with delayed oral hygiene practices, is strongly associated with caries incidence [2]. Sugar consumption was associated with a transient reduction in salivary pH, though it remained above the critical threshold for enamel demineralization. This effect may be attributed to the presence of sucrose, which has been shown to possess a low acidogenic potential [10]. Additionally, Nielsen and Popkin reported a transient increase in salivary pH following sugar intake, further supporting these observations. However, there was no significant difference in salivary pH among the groups at baseline and at 5 minutes post-intervention, by 15 minutes, a significant divergence was observed, with Group 1 exhibiting the highest pH and Group 3 the lowest. [11]. The clearance of coffee from the oral cavity occurred within 15 minutes, aligning with existing data on the rapid oral clearance of liquids. Solid sugar-containing foods tend to persist in the oral cavity for longer durations. When consumed frequently throughout the day, these substances can continuously expose the teeth to acidogenic challenges. Traditional candies such as Imli, Hajmola, and Awala (Indian gooseberry) are highly retentive and acidic, promoting prolonged acid exposure, which can lead to both dental caries and erosive lesions. However, consumption of such items alongside meals rather than in between may help reduce their cariogenic potential by enhancing oral clearance and salivary buffering.

Conclusion

A clinical trial involving 25 participants was conducted to assess changes in salivary pH, after the consumption of various available candies which are widely available near schools and colleges, making them popular among children and young adults. The study revealed that solids which not cleared quickly from the oral cavity, they exhibited significant cariogenic and erosive potential, causing a notable drop in salivary pH immediately after consumption. Therefore, limiting candies intake, particularly among children and young adults, is recommended for better oral health maintenance.

References

1. Hans R, Thomas S, Garla B, Dagli RJ, Hans MK. Effect of Various Sugary Beverages on Salivary pH, Flow Rate, and Oral Clearance Rate amongst Adults. Scientifica (Cairo). 2016;2016:5027283. doi: 10.1155/2016/5027283. Epub 2016 Mar 8. PMID: 27051556; PMCID: PMC4802044.

2. Jain K, Gakhar R, Bhatia S, Manjunatha BS, Jindal D, Jindal V. Comparison of salivary flow rate and pH between healthy subjects and tobacco and areca nut chewers. J Oral Maxillofac Pathol. 2023 Jul-Sep;27(3):599. doi: 10.4103/jomfp.jomfp_518_22. Epub 2023 Sep 12. PMID: 38033965; PMCID:

PMC10683918.

3. Llena-Puy C. The rôle of saliva in maintaining oral health and as an aid to diagnosis. Med Oral Patol Oral Cir Bucal. 2006 Aug;11(5):E449-55. English, Spanish. PMID: 16878065.

4. Kay E, Locker D. A systematic review of the effectiveness of health promotion aimed at improving oral health. Community Dent Health. 1998 Sep;15(3):132-44. PMID: 10645682.

5. Dimopoulou M, Antoniadou M, Amargianitakis M, Gortzi O, Androutsos O, Varzakas T. Nutritional Factors Associated with Dental Caries across the Lifespan: A Review. Applied Sciences. 2023; 13(24):13254. https://doi.org/10.3390/app132413254

6. Mandel ID. Impact of saliva on dental caries. Compend Suppl. 1989;(13):S476-81. PMID: 2691081.

7.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3800408/#:~:text=A%20saliva%20pH%20of%207.0,be%20found%20in%20this%20environment.

8. Baliga S, Muglikar S, Kale R. Salivary pH: A diagnostic biomarker. J Indian Soc Periodontol. 2013 Jul;17(4):461-5. doi: 10.4103/0972-124X.118317. PMID: 24174725; PMCID: PMC3800408.

9. Madukwe IU. Anatomy of the periodontium: A biological basis for radiographic evaluation of periradicular pathology. J Dent Oral Hygiene 2014; 6:70–76.

10. Ong G, Yeo JF, Bhole S. A survey of reasons for extraction of permanent teeth in Singapore. Community Dent Oral Epidemiol 1996; 24:124–127.

11. Agrawal AA, Kapley A, Yeltiwar RK, et al. Assessment of single nucleotide polymorphism at IL-1A+ 4845 and IL-1B+ 3954 as genetic susceptibility test for chronic periodontitis in Maharashtrian ethnicity. J Periodontol 2006; 77:1515–1521.

12. Kaarthikeyan G, Jayakumar ND, Padmalatha O, et al. Analysis of the association between interleukin-1β (+3954) gene polymorphism and chronic periodontitis in a sample of the south Indian population. Indian J Dent Res 2009; 20:37.

13. Amina M, Gayathri R, Priya VV. A detailed study on the function of neutrophils and macrophages in periodontitis. Drug Invention Today 2018; 10.

14. Marsh PD. Microbial ecology of dental plaque and its significance in health and disease. Adv Dent Res 1994; 8:263–271.

15. Ravi S, Malaiappan S, Varghese S, et al. Additive effect of plasma rich in growth factors with guided tissue regeneration in treatment of intrabony defects in patients with chronic periodontitis: a split-mouth randomized controlled clinical trial. J Periodontol 2017; 88:839–845.

16. Vijayashree Priyadharsini J. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. J Periodontol 2019; 90:1441–1448.

17. Alghamdi SB, Togoo RA, Bahamdan GK, et al. Changes in salivary pH following consumption of different

varieties of date fruits. J Taibah University Med Sci 2019; 14:246–251.

18. Ramesh, A. et al. (2018) Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients-A case-control study. J Periodontol 2018; 89:1241–124.

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