

A STUDY ON VARIATIONS OF SALIVARY pH WITH INTAKE OF FOOD

GOKUL G^{1*}, VISHNUPRIYA V², GAYATHRI R²¹Department of Biochemistry, Saveetha Dental College and Hospitals, Chennai, Tamil Nadu, India. ²Department of Biochemistry, Saveetha Dental College and Hospitals, Chennai, Tamil Nadu, India. Email: gokul.guna.1997.g@gmail.com

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ABSTRACT

Objective: Study the changes in salivary pH before and after consumption of food in college students.**Methods:** The study was conducted on 60 students from Saveetha Dental College by checking the pH of their saliva using a pocket pH meter and the data was entered and compared in SPSS software along with their diet.**Results:** The data showed significant change in the pH of saliva before and after food intake and consumption on certain food types leads to alkalinity of the oral cavity.**Conclusion:** This study helped in concluding the role of types of food in changing the pH of the oral cavity and thereby helps the need for proper selection on food is necessary and importance of buffering action in pH maintenance.**Keywords:** Saliva, pH, food

INTRODUCTION

Saliva is a watery substance located in the mouths of humans and animals, secreted by the salivary glands. Human saliva is 99.5% water, while the other 0.5% consists of electrolytes, mucus, glycoproteins, enzymes, and antimicrobial agents such as secretory immunoglobulin A and lysozyme [1]. There is much debate about the amount of saliva that is produced in a healthy person per day; estimates range from 0.75 to 1.5 L/day while it is generally accepted that during sleep the amount drops to almost zero [2].

Saliva plays an important role in maintaining the integrity of teeth by way of its buffering action and controlling the demineralization and promoting remineralization, occurring continuously at the enamel surface [3]. There is much debate about the amount of saliva that is produced in a healthy person per day; estimates range from 0.75 to 1.5 L/day while it is generally accepted that during sleep the amount drops to almost zero [4]. Saliva is implicated in a wide variety of physiological and biological processes that are crucial to the initial digestion in the upper parts of the gastrointestinal tract including lubrication during chewing so that the food can be swallowed [5]. The salivary flow rate, while chewing food, is elicited by gustatory and mechanical stimulation and the gustatory stimulation of natural food in producing the flow of saliva appeared to be much more important than the mechanical stimulation from chewing [6].

The salivary flow and composition such as mucins, sodium, proteolytic, and lipolytic activities help in the perception of flavor such as fat, sweetness, saltiness, astringency, bitterness, and retronasal aroma inside the mouth. However, few studies have explored the influence of salivary flow and saliva composition on individual taste liking or acceptance [7-10].

Saliva flow rate, buffer capacity, and microorganism content are very important for oral health.

Buffer solutions are solutions that maintain an approximately constant pH when small amounts of either acid or base are added or when the solution is diluted. In other words, buffers are resistant to changes in pH. There are three possible buffer systems in saliva – the protein buffer, phosphate buffer, and carbonic acid/bicarbonate buffer [11].

The protein buffer, however, is not very effective due to its lack of many ionized groups, which means that it does not have enough acidic/basic groups to remove OH⁻/H⁺ added, respectively. The phosphate buffer is active in unstimulated saliva [12]. The mechanism for the phosphate buffer system is due to the ability of the secondary phosphate ion, H₂PO₄⁻, to bind a hydrogen ion and form a primary phosphate ion H₂PO₄. Hence, the phosphate buffer has the potential to be an effective buffer in the mouth. However, its effectiveness in buffer action is lowered only due to the low concentrations of phosphate in the oral cavity. But during the resting state, when no food is present in the mouth, the concentration of phosphate would be higher than that of bicarbonate which would be quite efficient in unstimulated saliva. The carbonic acid/bicarbonate buffer is the major buffer in stimulated saliva, which acts mainly on acids produced by bacteria present in the oral cavity given as by-products when they digest sugars in the mouth or acids from the stomach and neutralize them. A normal salivary flow rate is required for a normal concentration of bicarbonate ions to be present. Once the food is present in the mouth, the pH decreases, and the bicarbonate ions concentration increases. The decrease of the pH is caused by increased concentrations of H⁺ in the plaque, due to lactic acid being produced by bacteria when they ferment carbohydrates. The buffering capacity of saliva is found to be responsible due to the presence of bicarbonate ions, secreted within the ducts. The concentration of bicarbonate is determined by the stimulation of saliva and by carbonic anhydrase VI (secreted by the serous acinar cells in the parotid and submandibular glands). While eating salivary flow rate increases the more bicarbonate is produced as a by-product of cell metabolism which diffuses into dental plaque and helps neutralize the increased amount of acid (H⁺) produced by the bacteria. The salivary pH increases with increasing bicarbonate concentrations.

This is convenient because a rise in bicarbonate usually occurs in stimulated saliva (when food is in the mouth), and H⁺ is produced by bacteria fermenting sugars in the food. This ensures that saliva pH is maintained well above the critical pH [11]. Salivary flow rate, buffer capacity, and streptococci mutans counts were significantly related to caries occurrence in some studies [13,14] and the evaluation of these factors has been proposed as a tool for caries risk assessment but was found to be less futile for its assessment. It was also found that low buffering capacity is imminent with caries development due to its

impaired neutralization of plaque acids and reduced remineralization of early enamel lesions [14,15].

An association between low caries levels and high salivary buffering capacity have been also demonstrated [16,17].

Table 1: Composition of male and female

Sex	Frequency	Percent	Valid percent	Cumulative percent
Valid				
Male	31	51.7	51.7	51.7
Female	29	48.3	48.3	100.0
Total	60	100.0	100.0	

Table 2: Comparison of means of the fasting and after food pH

Means of fasting pH v after food pH	Paired samples statistics			
	Mean	n	Standard deviation	Standard error mean
Pair 1				
Fasting pH	7.505	60	0.7806	0.1008
After food pH	7.95	60	0.707	0.091

Table 3: Significance in change of pH

pH fasting v pH after food	Paired differences				t	df	Sig. (2-tailed)	
	Mean	Standard deviation	Standard error mean	95% confidence interval of the difference				
				Lower				Upper
Pair 1								
Fasting pH-After food pH	-0.4467	0.9948	0.1284	-0.7037	-0.1897	-3.478	59	0.001

Table 4: Food taken after fast

Diet	Diet			
	Frequency	Percent	Valid percent	Cumulative percent
Valid				
Oil food	30	50.0	50.0	50.0
Confectionary	8	13.3	13.3	63.3
Non-vegetarian	6	10.0	10.0	73.3
Rice	11	18.3	18.3	91.7
Other foods (Wheat/millet, etc.)	5	8.3	8.3	100.0
Total	60	100.0	100.0	

Table 5: Comparison of pH before and after the consumption of food

Diet: Fasting pH v after food pH	Descriptives							
	n	Mean	Standard deviation	Standard error	95% confidence interval for mean		Minimum	Maximum
Fasting pH								
Oil food	30	7.560	0.7295	0.1332	7.288	7.832	6.5	9.8
Confectionary	8	7.275	0.9438	0.3337	6.486	8.064	6.0	9.0
Non-vegetarian	6	7.383	0.4834	0.1973	6.876	7.891	6.5	7.8
Rice	11	7.664	1.0356	0.3123	6.968	8.359	6.0	9.0
Other foods (Wheat/millet, etc.)	5			0.2619	6.613	8.067	6.5	7.9
Total	60			0.1008	7.703	7.707	6.0	9.8
After food								
Oil food	30	8.12	0.799	0.146	7.82	8.42	7	10
Confectionary	8	8.09	0.491	0.174	7.68	8.50	7	9
Non-vegetarian	6	8.27	0.686	0.280	7.55	8.99	7	9
Rice	11	7.45	0.281	0.085	7.26	7.63	7	8
Other foods (Wheat/millet, etc.)	5	7.46	0.358	0.160	7.02	7.90	7	8
Total	60	7.95	0.707	0.091	7.77	8.13	7	10

Table 6: Comparison of pH with consumption of cold drinks

Any cold drinks taken	Group statistics			
	n	Mean	Standard deviation	Standard error mean
Fasting pH				
Yes	19	7.368	0.5869	0.1347
No	41	7.568	0.8548	0.1355

The food taken by the students were divided into five categories: Oil food, confectionary, non-vegetarian, rice, and other foods (wheat/millet, etc.). The variation in the pH of saliva with respect to the type of food taken was compared to know the effect of diet on salivary pH. Significant changes were found in three cases of diet which include oil food (7.5-8.1 approximately), confectionary (7.2-8.1 approximately), and non-vegetarian (7.3-8.2 approximately). Thus, it can be inferred that the oral cavity becomes more alkaline while consuming oil food, confectionary and non-vegetarian food. The other foods such as wheat and millers (7.3-7.4) and rice (7.6-7.4) does not show a significant change in salivary pH (Tables 4-6).

On comparing, the consumption of intake of cold drinks and fasting pH, no significant decrease or increase in pH is noted. Thereby, one can conclude the effectiveness of buffer system in the oral cavity from the data given above.

CONCLUSION

This survey was conducted to analyze the change in pH in saliva with respect to the nature of diet consumed. From the study, it was observed that the mean pH of saliva during overnight fast was 7.3 while the mean pH post-prandial was found to be 8 (approximate). The survey was also done to check the influence of various foods in altering the salivary pH. The results had shown a noticeable increase in pH in the case of students who took non-vegetarian food. The pH for students who took rice and other foods such as wheat and millets showed no significant change. Therefore, one can conclude the importance of buffer system in the body, which plays a significant role in the maintenance of pH of the body and the importance of proper food selection and intake.

Further, research should be done on the proper buffer action of saliva in the mouth and the proper diet to be taken for the healthy maintenance of the oral cavity.

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