

Effect of Cheese and Xylitol Gum on Saliva pH and PHP Index

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Abstract— Background: Mastication of food in the mouth undergoes a process of mastication which stimulates salivary secretion so that it will facilitate the digestion of food. Foods that are beneficial for dental health are cheese, which contain lots of calcium, phosphate, casein and are able to reduce enamel demineralization. Cheese can stimulate and accelerate the release of saliva, so that through the ionization process it can increase the pH of saliva. Foods other than cheese that can reduce the number of bacteria that cause tooth decay is xylitol, its properties can inhibit the growth of plaque and accelerate the process of rebuilding tooth minerals. **Purpose:** To determine the effect of cheese consumption and xylitol chewing gum consumption on saliva pH and PHP index. **Method:** The type of research used is quasi-experimental, with a non-equivalent two group design pretest and posttest. The sampling technique was purposive sampling, as many as 66 people consisted of: 33 people in the group who were given cheese intervention and 33 people were given xylitol intervention. The measuring instrument used to measure the pH of saliva is using a pH meter and measuring plaque using the PHP-index status. Measurements were taken before and after the intervention in each group. Data analysis in this study used the paired sample test. **Result:** Saliva pH before and after consuming cheese showed $p=0.039$. The pH of saliva before and after consuming xylitol gum showed $p=0.035$. PHP index value before and after consuming cheese and xylitol gum showed the same $p=0,000$. **Conclusion:** there is an effect of cheese consumption and xylitol chewing gum consumption on saliva pH and PHP index.

Keywords— Cheese, Xylitol Gum, Saliva pH, PHP index.

I. INTRODUCTION

Changes in salivary secretion in humans can be caused by different and varied taste stimuli, stimuli from food odors. Mechanical stimulation of the oral mucosa and mastication of food. In the mouth, the food undergoes a process of mastication which stimulates the secretion of saliva so that it will facilitate the digestion of food [1–3].

Foods that are beneficial for dental health are cheese, which is another form of milk, which contains a lot of calcium, phosphate and casein which can combat enamel demineralization. Cheese can stimulate and accelerate the release of saliva the composition of saliva contains lysozyme which is able to kill certain bacteria so that it plays a role in the bacterial rejection system. Cheese is very good for dental health when eaten or after food, because the calcium and protein contained in cheese will help neutralize acids in the mouth, so that through the ionization process it can raise the pH of saliva [4–6].

Another food that can also stimulate salivary secretion is xylitol gum, which is a white crystalline compound that is odorless and sweet in taste. Chewing xylitol will trigger the production of saliva which contains a lot of mineral essential for tooth enamel. This condition is considered very beneficial for dental health because it can repair the outer layer of the tooth. Xylitol was able to suppress the number of bacteria that cause tooth decay, inhibit the growth of plaque and accelerate the process of re-forming tooth minerals. This mechanism is actually the reason why xylitol can inhibit the growth of harmful bacteria on the teeth [7–9].

Based on the results of preliminary research on students at SMPN 15 Tasikmalaya City, it was obtained data that from

129 students the caries prevalence was 97.14%, namely the condition of many students' teeth with cavities.

II. RESEARCH METHODOLOGY

The type of research used is quasi-experimental, with a non-equivalent two group design pretest and posttest. This research was conducted on students of SMPN 15 Tasikmalaya City. The sampling technique was purposive sampling, as many as 66 people consisted of: 33 people in the group who were given cheese intervention and 33 people were given xylitol intervention. The measuring instrument used to measure the pH of saliva is using a pH meter and measuring plaque using the PHP-index status [10]. Measurements were taken before and after the intervention in each group. Data analysis in this study used the paired sample test

III. RESEARCH RESULT

TABLE 1. Frequency distribution of characteristics of the respondents

Gender	Cheese intervention		Xylitol intervention	
	Frequency	Percent	Frequency	Percent
Male	14	42.4	14	42.4
Female	19	57.6	19	57.6
Total	33	100	33	100

Table 1 shows that the characteristics of the respondents in the intervention group consuming cheese and xylitol chewing gum have the same proportions for both males and females.

TABLE 2. Frequency distribution of the saliva pH of intervention group consuming cheese

Saliva pH	Pre-test		Post-test	
	Frequency	Percent	Frequency	Percent
Acid	8	24.2	9	27.3
Neutral	7	21.2	13	39.4
Alkaline	18	54.6	11	33.3
Total	33	100	33	100

Table 2 shows that the saliva pH before consuming cheese which has an acidic pH (24.2%) after consuming cheese an acidic pH becomes (27.3%), which has a neutral pH (21.2%) after consuming cheese normal pH becomes (39.4%), and those who have an alkaline pH before (54.6%) after consuming cheese the alkaline pH becomes (33.3%)

TABLE 3. Frequency distribution of the saliva pH of intervention group consuming xylitol gum

Saliva pH	Pre-test		Post-test	
	Frequency	Percent	Frequency	Percent
Acid	2	6.1	0	0
Neutral	3	9.1	0	0
Alkaline	28	84.8	33	100
Total	33	100	33	100

Table 3 shows that the saliva pH before consuming xylitol which has an acidic pH (6.1%) after consuming xylitol, the pH is acidic to (0%), which has a neutral pH (9.1%) after consuming xylitol, the pH is neutral to (0%), and which has alkaline pH before (84.8%) after consuming cheese alkaline pH to (100%)

TABLE 4. Frequency distribution of the PHP index of intervention group consuming cheese

PHP index	Pre-test		Post-test	
	Frequency	Percent	Frequency	Percent
Good	1	3	14	42.4
Moderate	13	39.4	19	57.6
Bad	19	57.6	0	0
Total	33	100	33	100

Table 4 shows that the PHP index before consuming cheese, which includes PHP Index good criteria (3%) after consuming cheese PHP Index becomes (42.4%), PHP Index moderate criteria (39.4%) after consuming cheese PHP Index becomes (57.6%) and PHP index with bad criteria before consuming cheese (57.6%) after consuming cheese PHP Index being (0%).

TABLE 5. Frequency distribution of the PHP index of intervention group consuming xylitol gum

PHP index	Pre-test		Post-test	
	Frequency	Percent	Frequency	Percent
Good	1	3	11	33.3
Moderate	13	39.4	22	66.7
Bad	19	57.6	0	0
Total	33	100	33	100

Table 5 shows that the PHP index before consuming xylitol, which includes PHP Index good criteria (3%) after consuming xylitol PHP Index becomes (33.3%), PHP Index moderate criteria (39.4%) after consuming xylitol PHP Index becomes (66.7%), and PHP index with bed criteria before consuming xylitol (57.6%) after consuming cheese PHP Index being (0%)

TABLE 6. Result of analysis of Paired Samples Test Saliva pH before and after consuming cheese and xylitol

Saliva pH	Mean±SD	p-value
Consuming cheese	1.169±0.453	0.039
Consuming xylitol gum	-0.157±0.411	0.035

Table 6 shows that analysis of paired samples test saliva pH test before and after consuming cheese obtained a mean of 0.169 with $p = 0.039$ while for the treatment of xylitol chewing gum the mean was -0.157 with $p = 0.035$.

TABLE 7. Result of analysis of Paired Samples Test PHP index before and after consuming cheese and xylitol

PHP Index	Mean±SD	p-value
Consuming cheese	1.166±0.531	0.000
Consuming xylitol gum	1.284±0.631	0.000

Table 7 shows that analysis of paired samples test PHP index test before and after consuming cheese obtained a mean of 1.166 with $p = 0.000$ while for the treatment of xylitol chewing gum the mean was 1.284 with $p = 0.000$.

IV. DISCUSSION

The results of the study stated that consuming cheese and xylitol was very significant in changing saliva as evidenced by changes in concentration from acid to alkaline, neutral to alkaline or from acid to normal, in this study there was no significant signification in inhibiting plaque growth, changes in saliva in the mouth by consuming cheese and xylitol only slow down plaque growth for a short time.

The pH of the saliva in the mouth at rest tends to be normal because there is no mechanical or chemical activity caused. The degree of acidity of saliva in low secretions is more alkaline with a watery-thick concentration with a pH of about 7.0. Saliva is produced at the time of eating by 90%, this process is a reaction to the stimulation of the taste buds from chewing food [11–13]. Foods that can affect salivary secretion and salivary pH in the mouth include foods such as cheese and xylitol [6].

Cheese is not only good for health it is also very good for teeth. When you eat cheese, the calcium and protein contained in cheese will help neutralize acids in the mouth, so that through the ionization process, it can raise the pH of saliva. However, after eating cheese, plaque will easily accumulate on the teeth. The rest of the food that sticks to the teeth will react with the inhabitants of our mouth (enzymes, saliva, bacteria, germs, acids and alkaline). The reaction that occurs is the decomposition of food debris which can later cause caries/cavities, in addition to food residue left on the surface of the teeth can cause bad breath, the description above even though cheese is good for oral health and teeth, brushing teeth after eating is the most important thing for prevent the accumulation of plaque on the teeth. Based on statistical results, it was found that there was an effect of cheese consumption on saliva pH [4].

Xylitol is considered to be able to prevent the formation of acidic compounds on the plaque layer on the surface of the teeth and stimulate the production of saliva which is rich in calcium content to accelerate the process of rebuilding the mineral layer of the teeth. The average saliva acidity from the research results that consumption of xylitol gum as much as 90.74% has a salivary acidity (pH) above 7. This is because the pH of total saliva at low secretions is more similar to the pH of mucus saliva, which is approximately 7.0 and up to 7.5–8.0. The concentration of bicarbonate in the stimulated saliva

contributes 85% to the buffer capacity, which means it will also increase the salivary pH, depending on the ratio of the acid to the conjugate base in question. Another factor that causes the pH of saliva to rise is when it is in the open air, this is because the loss of CO² and H⁺ is very low. Because in the saliva there is a buffer system so that the rise and fall of salivary pH due to food can be prevented [8,12,14].

Based on the results of statistical tests using a paired sample test for PHP index before and after consuming cheese and xylitol chewing gum, it shows $p=0.000$, it can be concluded that the PHP index results measured before and after consuming cheese and xylitol chewing gum show $p=0.000$ statistically very meaningful because $p<0.05$.

Based on the test results, it was found that the pH of saliva before and after consuming cheese was $p = 0.039$ while for the xylitol treatment $p = 0.035$, meaning that there was an effect of consuming xylitol gum on the pH of the saliva. In other words, cheese and chewing gum both have the ability to stimulate and accelerate salivation. Cheese and xylitol have the same function, which is to stimulate and accelerate the release of saliva. The content contained in cheese and xylitol gum is able to suppress the number of bacteria that cause tooth decay, suppress plaque acidity and accelerate the process of re-forming tooth minerals.

V. CONCLUSION

Based on the results of the study, it can be concluded there is an effect of cheese consumption and xylitol chewing gum consumption on saliva pH and PHP index.

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