



ANALYSIS OF SALIVARY PH DIFFERENCES AFTER CHEWING XYLITOL GUM AND APPLYING CASEIN PHOSPHOPEPTIDE-AMORPHOUS CALCIUM PHOSPHATE (CPP-ACP) IN GRADE VIII STUDENT OF SMPN 17 TASIKMLAYA CITY

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ABSTRACT

Problem statement: The prevalence of dental and oral health problems in Indonesia in adolescents aged 10-14 years is 55.6% and the prevalence of caries in children aged 10-14 years is 73.4%. Adolescents are categorized as quite susceptible to dental caries. One way to prevent dental and oral disease is by chewing xylitol gum and applying *Casein Phosphopeptide-Amorphous Calcium Phosphate* (CPP – ACP). Xylitol cannot be metabolized by *Streptococcus mutans* and the application of *Casein Phosphopeptide-Amorphous Calcium Phosphate* (CPP-ACP) can inhibit the demineralization process in teeth so as to prevent caries. **Purpose:** This study aims to determine how the pH of saliva compares after chewing xylitol gum and applying *Casein Phosphopeptide-Amorphous Calcium Phosphate* (CPP-ACP) in class VIII students at SMPN 17 Tasikmalaya City. **Method:** this study used method (quasi experiment, with non-equivalent design one group pre-test and post-test) research design as many as 61 students. The measuring instrument of the study uses universal indicators. Data analysis using *Wilcoxon* and *Mann-Whitney tests*. **Results:** based on statistical test results before and after chewing xylitol gum intervention, salivary pH was obtained from 6.19 to 6.74, *Wilcoxon test* results obtained p-value 0.017 and after CPP-ACP smearing intervention, salivary pH results were obtained 6.74 to 7.00 *Wilcoxon test* results obtained values p value 0.006. The results of the *mann-whitney* statistical test obtained a p-value of 0.015. **Conclusion:** There was a difference in salivary pH after chewing xylitol gum and applying *Casein Phosphopeptide-Amorphous Calcium Phosphate* (CPP-ACP) in grade VIII students of SMPN 17 Tasikmalaya city.

Keywords: Xylitol; CPP-ACP; Salivary pH; Caries; Calculus

Introduction (Pendahuluan)

The mouth is one of the first and main digestive organs that plays a role in the process of breaking down food so that it is smaller in size and the texture is smooth enough to be processed by other digestive organs [1].

Dental and oral health is a healthy condition of the hard and soft tissues of the teeth, as well as the related elements in the oral cavity, which allows individuals to eat, speak and interact socially without dysfunction, aesthetic disturbances and discomfort due to disease, occlusion deviation and loss. teeth so that they are able to live socially and economically productive lives [2].

Caries is a dental and oral disease that often occurs. The results of research by the World Health Organization (WHO) in 2019 showed that the prevalence of caries in adult teeth in the world was 29% and reached more than 2 billion cases. In 2019, the prevalence of caries in the Southeast Asia region was 28.69% and reached 5 million cases [3].

The results of RISKESDAS in 2013 showed that the prevalence of dental and oral health problems that often occurred in adolescents aged 10-14 was 25.2%, this was due to the wrong way of brushing teeth and insufficient frequency of brushing teeth. In 2013, West Java was included in the top 11 provinces which contributed the highest prevalence rate of dental and oral health problems, namely 28.0% [4].

The results of RISKESDAS (2018) show that the prevalence of dental and oral health problems in adolescents aged 10-14 years has increased to 55.6%. In 2018, West Java was included in the top 10 provinces that contributed the highest prevalence rate of dental and oral health problems, namely 58.0%, including the prevalence of caries and gingivitis caused by calculus. The highest prevalence of dental and oral health problems was 58.0%, including the prevalence of caries and gingivitis caused by calculus. The prevalence of dental and oral health problems based on research results from RISKESDAS in 2013 and 2018 saw a significant increase, namely 30.4%, which can be categorized into the high category [5].

Caries is a chronic disease in the form of chronic and continuous loss of mineral ions from the enamel surface of the crown or root surface of the tooth caused by bacteria and the products they produce and requires sufficient time for this process to occur [6]. One of the factors causing caries is saliva, with a change in saliva pH to acid, there is a 3.3 times greater risk of experiencing dental caries compared to normal saliva pH status [7]. The degree of acidity contained in saliva (salivary pH) is an important factor that plays a role in the oral cavity. Saliva can function optimally if the pH balance is maintained [8].

Caries is a dental and oral disease that often occurs in teenagers and is always ignored and not treated as long as it does not hurt, even though caries that have been left for a long time have an impact on various aspects of life. The impacts of caries include affecting the quality of life of teenagers, causing acute and chronic infections in tissues in the oral cavity, and can cause disabilities in the next generation [9].

Calculus is one of the dominant dental and oral health problems besides caries. Calculus can be found in all groups, especially among teenagers. Calculus is a hard deposit that sticks to the surface of the teeth and is yellowish, brownish to blackish in color [10]. Changes that occur in saliva pH have a significant effect on the formation of calculus. The impact of calculus on the tooth surface can cause loose teeth, bad breath, gingivitis and periodontitis which can damage the jaw bone structure [11].

The prevalence of caries and calculus as explained above shows that there is a need for early prevention of dental caries and calculus formation, namely by administering remineralization agents such as *Casein Phosphopeptide Amorphous-Calcium Phosphate* (CPP-ACP) which can inhibit the process of demineralization in teeth [12], apart from remineralization materials, it is necessary to stimulate the salivary glands, one of which is by chewing xylitol gum which can influence saliva secretion to increase so that food residue does not stick too much to the surface of the teeth. which is one of the initial causes of calculus formation and caries [13].

Previous research states that *Casein Phosphopeptide-Amorphous Calcium*

Phosphate (CPP-ACP) has been proven to prevent caries and can increase salivary pH [14].

Apart from applying CPP-ACP, chewing gum containing xylitol can inhibit the formation of plaque on the surface of the teeth because xylitol cannot be fermented by bacteria and by chewing xylitol gum it can stimulate saliva production to increase so that it can inhibit the accumulation of plaque formation on the surface of the teeth as well as an antidote. bacteria [15].

The aim of this study was to find out how the pH of saliva compares after chewing xylitol gum and applying it *Casein Phosphopeptide-Amorphous Calcium Phosphate* (CPP-ACP) in class VIII students at SMPN 17 Tasikmalaya City.

Methods
(*Metode Penelitian*)

This type of research design uses a quantitative descriptive research type using a research design like *an experiment*. The first stage carried out for this research was preparing a permit letter, research measuring instruments as well as tools and materials such as dental examination tools in the form of oral *diagnostic*, saliva pH examination sheet, and informed *consent*.

The research was conducted at SMPN 17 Tasikmalaya City, which was carried out in May 2023 at one time. The population in this study was 61 students aged 10-16 using the technique purposive *sampling* for sample determination.

The data collection technique for primary data is carried out by collecting saliva and inspection *pH saliva* directly and for secondary data from book and journal references.

Researchers divided two intervention groups. Each group received one intervention and before the research was carried out the respondents brushed their teeth together. Group one consisting of 31 respondents was given intervention in the form of chewing 3 pieces of xylitol gum for 5 minutes. Group two consisting of 30 respondents was given intervention in the form of smearing *Casein Phosphopeptide-Amorphous Calcium Phosphate* (CPP-ACP) and left for 5 minutes.

Salivary pH checks on respondents were carried out in class using APD, using *Universal Indicator Paper* and assisted by students who

have carried out calibration to record saliva pH before and after the intervention is given. The research results can be seen after *Universal Indicator Paper* inserted into the respondent's saliva sample for 2 minutes to determine whether there was an increase or decrease in the pH of the respondent's saliva.

The data taken in this study was saliva pH before and after the intervention was given. After the data is collected, the data is summarized and input for SPSS analysis using tests *Wilcoxon* to find a comparison of changes in saliva pH before and after intervention for the same group and test *Mann-Whitney* to see a comparison of the effectiveness of two different variables.

Results and Discussion
(*Hasil dan Pembahasan*)

The results of salivary pH measurements before and after the intervention was given to respondents are as follows:

Table 1. Student Gender Frequency Distribution

No	Gender	Amount	Percentage (%)
1.	Man	36	59,1%
2.	Woman	25	40,9%
Total		61	100%

Table 1 above can be explained that 61 students in class VIII-E and VIII-G SMPN 17 Tasikmalaya City are students of the type male genitals as many as 36 students (59.1%) and as many as women (40.9%).

Table 2. Frequency Distribution of Student Age

No	Age	Amount	Percentage (%)
1.	14 years	25	41%
2.	15 years	34	55,7%
3.	16 years	2	3,3%
Total		61	100%

Table 2 above can be explained that the 61 students in class VIII-E and VIII-G of SMPN 17 Tasikmalaya City were mostly 15 years old, namely 34 students (55.7%).

Table 3. Frequency Distribution of Salivary pH Before Chewing Xylitol Gum

No	Criteria	Amount	Percentage (%)
1.	Sour	19	61,2%
2.	Neutral	6	19,4%
3.	Work	6	19,4%
Total		31	100%

Table 3 above can be explained based on the frequency distribution of saliva pH before being given the intervention, chewing xylitol gum was mostly in the acid criteria as many as 19 students (61.2%).

Table 4. Frequency Distribution of Salivary pH Before CPP-ACP Application

No	Criteria	Amount	Percentage (%)
1.	Sour	19	63,3%
2.	Neutral	4	13,3%
3.	Work	7	23,4%
Total		30	100%

Table 4 above can be explained based on the frequency distribution of saliva pH before administering the application intervention *Casein Phosphopeptide-Amorphous Calcium Phosphate* (CPP-ACP) most often were in the acid criteria as many as 19 students (63.3%).

Table 5. Frequency Distribution of Saliva pH After Chewing Xylitol Gum

No	Criteria	Amount	Percentage (%)
1.	Sour	9	29,03%
2.	Neutral	21	67,7%
3.	Work	1	3,27%
Total		31	100%

Table 5 above can be explained based on the frequency distribution of saliva pH After chewing xylitol gum, most of the 21 students (67.7%) were in the neutral criteria.

Table 6. Frequency Distribution of Saliva pH After Application of CPP-ACP

No	Criteria	Amount	Percentage (%)
1.	Sour	1	3,3%
2.	Neutral	28	93,4%
3.	Work	1	3,3%
Total		30	100%

Table 6 above can be explained based on the frequency distribution of saliva pH after

smearing *Casein Phosphopeptide-Amorphous Calcium Phosphate* (CPP-ACP) were mostly in the neutral criteria as many as 28 students (93.4%).

Table 7 Frequency Distribution of Saliva pH Before and After Chewing Xylitol Gum

No	Criteria	Before		After	
		N	(%)	N	(%)
1.	Sour	19	61,2	9	29,03
2.	Neutral	6	19,4	21	67,70
3.	Work	6	19,4	1	3,27
Total		31	100	31	100

Table 7 shows that the recapitulation results of saliva pH in class VIII-E students at SMPN 17 Tasikmalaya City before being given the intervention to chew xylitol gum and after being given the intervention to chew xylitol gum experienced an increase in changes in saliva pH from 19.4% to 67.7% of the criteria. Neutral salivary pH, for criteria *pH saliva* acid decreased from 61.2% to 29.03% and for basic criteria decreased from 19.4% to 3.27%

Table 8. Frequency Distribution of Saliva pH Before and After Application CPP-ACP

No	Criteria	Before		After	
		N	(%)	N	(%)
1.	Sour	19	63,3	1	3,3
2.	Neutral	4	13,3	28	93,4
3.	Work	7	23,4	1	3,3
Total		30	100	30	100

Table 8 shows that the recapitulation results of saliva pH in class VIII-G students at SMPN 17 Tasikmalaya City before being given the CPP-ACP application intervention and after being given the CPP-ACP application intervention experienced an increase in changes in saliva pH from 13.3% to 93.4% of the criteria. Neutral saliva pH, for acidic saliva pH criteria decreases from 63.3% to 3.3% and for basic criteria decreased from 23.4% to 3.3%.

Table 9. Statistical Test Results Wilcoxon Effectiveness of Chewing Xylitol Gum Against Saliva PH

Variable	Asymp. Sig
Salivary pH before and after chewing gum <i>xylitol</i>	0,017

Table 9 above can explain the test results *wilcoxon* in the group *pre-test* and *post-test* earned *p-value (2-tailed)* 0.017. The value of 0.017 is smaller than 0.05, so it can be concluded that the hypothesis is accepted, which means there is a change in saliva pH before and after chewing xylitol gum in the control group and intervention group so it can be concluded that chewing xylitol gum can influence saliva pH to become neutral in class VIII-E students at SMPN 17 Tasikmalaya City.

Table 10. Statistical Test Results Wilcoxon CPP-ACP Coating Comparison Against Saliva pH

Variable	Asymp. Sig
Salivary pH before and after application of CPP-ACP	0,006

Table 10 above can explain the test results *wilcoxon* in the group *pre-test* and *post-test* earned *p-value (2-tailed)* 0.006. The value of 0.006 is smaller than 0.05, so it can be concluded that the hypothesis is accepted, which means there is a change in saliva pH before and after application *Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP)* in the control group and intervention group so it can be concluded that the application of CPP-ACP remineralization agent can influence the pH of saliva to become neutral in class VIII-G students at SMPN 17 Tasikmalaya City.

Table 11. Statistical Test Results Mann-Whitney Intervention Group

Test Statistics	Intervention Results
<i>Mann-Whitney U</i>	349.000
<i>Asymp. Sig. (2-tailed)</i>	0.015

Table 11 above can be explained that test results *Maan Whitney* In the intervention group, namely chewing xylitol gum and applying CPP-ACP, scores were obtained *asymp. sig (2-tailed)* of 0.015. The value of

0.015 is smaller than 0.05, so it can be concluded that the hypothesis is accepted, which means there are differences in the intervention group, namely chewing xylitol gum and CPP-ACP application on saliva pH. Because there is a significant difference, it can be said that there is an influence of chewing xylitol gum and applying CPP-ACP on the saliva pH of students in classes VIII-E and VIII-G at SMPN 17 Tasikmalaya City.

Prevention of caries has always been a very broad field of research and there has been a constant search to identify measures to prevent caries. Increasing the defense mechanisms inherent in saliva and reducing the level of development of microorganisms is one rational approach. Protection mechanisms are divided into two categories, namely physical and chemical. The physical defense of saliva includes an increased level of saliva secretion which can neutralize the development of microorganisms on the tooth surface. There are two natural endogenous chemical protective mechanisms, namely salivary pH and salivary buffers which can control the balance so that it can neutralize the occurrence of demineralization in teeth [16].

Demineralization that occurs in teeth is caused by the activity of bacteria *streptococcus mutans* which is the main cause of caries [17].

Stimulus applied to the salivary glands can influence the process of saliva buffering and saliva secretion, including by chewing xylitol gum and administering remineralization agents such as *Casein Phosphopeptide Amorphous Calcium Phosphate (CPP-ACP)*. Remineralization ingredients such as CPP-ACP have been used in various studies to assess the anticariogenic potential in the form of toothpaste in line with research conducted by Ratuella, et al (2019) that CPP-ACP is very effective in raising saliva pH towards normal and can prevent demineralization in tooth.

The CPP-ACP content can be found in nature, namely in cow's milk. The high calcium and protein content in CPP-ACP can inhibit the occurrence of caries. Complex *Casein Phosphopeptide (CPP)* and *Amorphous Calcium Phosphate (ACP)* can inhibit the emergence of caries lesions by increasing the level of ACP in dental plaque so

that it acts to suppress demineralization of the enamel and increase the remineralization of tooth enamel [18].

A comparative study was carried out by Padminee., et al, 2018 regarding the effectiveness of CPP-ACP with xylitol on the acidity of salivary pH and it can be concluded that CPP-ACP has better efficacy compared to xylitol in maintaining salivary pH.

The results of the research that has been carried out show the test results *wilcoxon* in the group *pre-test* and *post-test* earned *p-value* (2-tailed) 0.006. The value of 0.006 is smaller than 0.05, so it can be concluded that the hypothesis is accepted, which means there is a change in saliva pH before and after application *Casein Phosphopeptide-Amorphous Calcium Phosphate* (CPP-ACP) in the control group and intervention group so it can be concluded that the application of CPP-ACP remineralization agent can influence the pH of saliva to become neutral in class VIII-G students at SMPN 17 Tasikmalaya City.

Conclusion

(Simpulan)

There were differences in the intervention group, namely chewing xylitol gum and CPP-ACP application on saliva pH. Because there is a significant difference, it can be said that there is an influence of chewing xylitol gum and applying CPP-ACP on the saliva pH of students in classes VIII-E and VIII-G at SMPN 17 Tasikmalaya City.

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