

## ARTIKEL PENELITIAN

# The Changes in Color of Pineapple Stem Extract (*Ananas comosus* (L.) Merr) with Carbamide Peroxide as a Dental Bleach toward Dental Surface Violence in Vitro

Deli Mona<sup>1</sup>, Laura Ajeng Dyalova<sup>2</sup>

1.Lecturer at the Faculty of Dentistry, Andalas University, Padang, West Sumatra, Indonesia;  
2S.tudents of the Faculty of Dentistry, Andalas University, Padang, West Sumatra, Indonesia.

**Korespondensi:** Deli Mona, email:delimona0505@gmail.com

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### Abstrak

**Tujuan:** Penelitian ini bertujuan untuk mengetahui perbandingan efektivitas ekstrak batang nanas (*Ananas comosus* (L.) Merr) dan *home bleaching* karbamid peroksida sebagai bahan pemutih gigi. **Metode:** Metode penelitian ini adalah laboratorium eksperimental in vitro. Sampel adalah 28 gigi premolar pasca ekstraksi yang dibagi menjadi 4 kelompok (konsentrasi ekstrak batang nanas 50%, 75%, dan 100%) dan kontrol yang direndam dalam karbamid peroksida 10%. Pengukuran perubahan warna diamati dengan shade guide Vitapan Classical. Analisis data menggunakan uji Kruskal Wallis ( $p < 0,05$ ). **Hasil:** Hasil penelitian menunjukkan bahwa rerata perbedaan warna gigi masing-masing konsentrasi ekstrak batang nanas 50%, 75%, 100% dan karbamid peroksida 10% adalah 8,14, 10,14, 12,00 dan 9,14. Rerata tertinggi adalah ekstrak batang nanas 100% dan rerata terendah adalah ekstrak batang nanas 50%. **Kesimpulan:** Kesimpulan dari penelitian ini adalah ekstrak batang nanas 100% lebih efektif dibandingkan ekstrak batang nanas 50%, konsentrasi 75% dan karbamid peroksida 10%.

**Kata kunci:** Ekstrak batang nanas; karbamid peroksida; Pemutihan gigi Tingkat stres; Konsumsi makanan cepat saji

### Abstract

**Objective:** The purpose of this research was to determine the effectiveness comparison of pineapple stem extract (*Ananas comosus* (L.) Merr) and carbamide peroxide home bleaching for tooth whitening agent. **Methods:** The method of this research was in vitro experimental laboratory. The sample was 28 post-extracted premolar teeth divided into 4 groups (50%, 75%, and 100% concentration of pineapple stem extract) and control soaked in carbamide peroxide 10%. The measurement of color changes was observed with shade guide Vitapan Classical. This study used Kruskal Wallis test for data analysis ( $p < 0.05$ ). **Results:** This research showed that the mean of tooth color difference respectively for 50%, 75%, 100% concentration of pineapple stem extract and carbamide peroxide 10% were 8.14, 10.14, 12.00 and 9.14. The highest mean was pineapple stem extract 100% and the lowest mean was pineapple stem extract 50%. **Conclusion:** The conclusion of this study was pineapple stem extract 100% was more effective than 50%, 75% concentration of pineapple stem extract and carbamide peroxide 10%.

**Keywords:** Pineapple stem extract; Carbamide peroxide; Tooth whitening Stress level; Consumption of junk food

## INTRODUCTION

The appearance of the teeth is one of the things that determines the attractiveness of facial appearance. Some of the factors that influence the appearance of the teeth are tooth color, tooth shape, tooth position, and the quality of the restoration. Tooth color is one of the factors that determine satisfaction with the appearance of one's teeth.<sup>1</sup> Teeth have an important role in producing an attractive smile. Tooth color is one of the things that people pay attention to when someone smiles. Tooth discoloration can make a person less confident, such as lazy to speak and lazy to smile. Tooth discoloration can be caused by several factors both intrinsically such as heredity and drugs as well as extrinsically such as smoking and consuming chromogenic foods and drinks such as coffee and tea.<sup>2,3</sup>

Teeth whitening can be done using chemicals and natural ingredients. Generally, the chemicals used in dentistry as teeth whitening are hydrogen peroxide and carbamide peroxide. Carbamide peroxide is more commonly used as a home bleaching agent, the advantages of home bleaching are relatively easy application, more affordable costs, and a high percentage of success, but the use of chemicals for teeth whitening is currently debated because of the impact it can have on hard tissue and oral soft tissue. The use of teeth whitening agents with high concentrations and for a long time can cause excessive sensitivity to the teeth and can harm the mucosa and gingiva. The negative effects during teeth whitening can be attributed to the low pH, oxidation reactions and composition of the teeth whitening agent.<sup>4,5,6,7,8</sup>

Pineapple fruit (*Ananas comosus* L. Merr) is one type of fruit found in Indonesia which has an even distribution. Indonesia ranks sixth highest in pineapple fruit production after Thailand, Brazil, Costa Rica, the Philippines and China. Pineapple is one of the leading fruit commodities in Indonesia.<sup>2,9,10,11</sup> Tooth whitening materials are acidic and have a low pH, which oxidizes the surface of the tooth enamel to become neutral and causes a whitening effect on teeth color, but the acidic nature of teeth whitening materials can cause tooth structure loss.<sup>2</sup> Tooth whitening products have a pH between 4-7.<sup>5,12</sup> Based on the description above, the researcher is interested in conducting research to determine the difference in the color of the pineapple hump extract with the carbamide peroxide home bleaching agent as a tooth whitening agent against tooth surface hardness.

## METHODS

### Experimental Design

This type of research plan is a laboratory experimental research design with pre-test and post-test with control group design. The sample in this study were maxillary premolar teeth obtained from several dental practices and health centers in Padang City that met the inclusion and exclusion criteria. This research was conducted at the UPTD Laboratory of the West Sumatra Province Health Center and the Microbiology Laboratory of the Faculty of Medicine, Andalas University, Padang, West Sumatra.

### Pineapple Stem Extract

This research was conducted by preparing tools and materials and coating the roots of the teeth using clear nail polish, after which the initial tooth color

was determined (pretest). The skin of the pineapple is peeled, then the hump / liver is taken then washed with running water until clean. The cobs of pineapple that have been washed are then cut into small pieces using a knife. The pineapple pieces were extracted with 96% ethanol solvent and stirred evenly for 30 minutes, then left to stand for 24 hours after which it was filtered and obtained residue and filtrate. The filtrate is evaporated using a rotary evaporator and concentrated with a water bath so that a thick pineapple extract is obtained. Then dilution is carried out by adding distilled water to the extraction results to make pineapple extract concentrations of 50% and 75%. After the extraction process is complete, the extract of pineapple hump and carbamide peroxide is applied to the tooth  $\pm$  2 ml to cover the tooth crown, and then the tooth is put into the treatment container. Each container was placed in an incubator at 37 °C for 4 hours. After 4 hours the sample was rinsed under running water for 20 seconds to remove the pineapple extract

Univariate analysis was performed to determine the average and standard deviation of differences before and after teeth whitening using 50%, 75%, and 100%

and carbamide peroxide. Then soaked in artificial saliva and placed in an incubator at 37 °C for 20 hours. The procedure was repeated daily for 14 days following the control group. After whitening the teeth using the extract of pineapple with a concentration of 50%, 75% and 100% and 10% carbamide peroxide for 14 days, the teeth were rinsed and dried, then the tooth color was measured again to see the discoloration of the teeth using the Vitapan Classical shade guide. Tooth color determination was carried out at 12.00-13.00.

### Statistical Analysis

The data obtained were analyzed using computerized data and displayed in tabular form. The normality test with the Shapiro Wilk test was then carried out by the Krsukak Wallis test to see the differences in all treatment groups.

## RESULT AND DISCUSSION

concentrations of pineapple extract, and 10% carbamide peroxide. The results of the univariate analysis can be seen in Table 1.

**Table 1. Average value of tooth color before and after being treated**

Treatments	Pre-test		Post-test		Deviation	
	Mean	SD	Mean	SD	Mean	SD
100% pineapple stem extract	13.00	1.414	1.00	0.00	12.00	1.414
75% pineapple stem extract	11.43	1.134	1.29	0.488	10.14	0.900
50% pineapple stem extract	9.86	1.069	1.57	0.535	8.14	0.378
10% carbamide peroxide	10.57	1.134	1.43	0.535	9.14	0.690

Table 1 shows that the pineapple extract with a concentration of 100% had the greatest average color change, namely 12.00, while the pineapple stem extract with a concentration of 75% had an average color change of 10.14. The average

color change in 10% carbamide peroxide as a control group was 9.14, while the smallest color change was shown by the pineapple hump extract with a concentration of 50% which had an average color change of 8.14.

**Table 2. Normality Test of Saphiro Wilk**

	Treatments	n	p	Explanation
Pre-test	100% pineapple stem extract	7	0.005	Abnormal
	75 % pineapple stem extract	7	0.262	Normal
	50% pineapple stem extract	7	0.026	Abnormal
	10% carbamide peroxide	7	0.262	Normal
Post-test	100% pineapple stem extract	7	0.000	Abnormal
	75 % pineapple stem extract	7	0.000	Abnormal
	50% pineapple stem extract	7	0.001	Abnormal
	10% carbamide peroxide	7	0.001	Abnormal
Deviation	100% pineapple stem extract	7	0.005	Abnormal
	75 % pineapple stem extract	7	0.062	Normal
	50% pineapple stem extract	7	0.000	Abnormal
	10% carbamide peroxide	7	0.099	Normal

The results of the normality test show that the distribution of the data has an abnormal distribution so that the data

test uses the Wilcoxon test, the Kruskal Wallis test, and followed by the Post-hoc Mann Whitney test.

**Table 3. Wilcoxon Test Results**

Treatment Group	Variable	n	Mean	SD	p-value
100% pineapple steml extract	Pre-test	7	13.00	1.414	0.016
	Post-test	7	0.00	0.000	
75 % pineapple stem extract	Pret-est	7	11.43	1.134	0.017
	Post-test	7	1.29	0.488	
50% pineapple stem extract	Pre-test	7	9.86	1.069	0.011
	Post-test	7	1.57	0.535	
10% carbamide peroxide	Pre-test	7	10.57	1.134	0.016
	Post-test	7	1.43	0.535	

Table 3 shows that there is a significant difference in tooth discoloration between before and after soaking using pineapple hump extract with a

concentration of 50, 75, 100%, and 10% carbamide peroxide because the four variables have a p value <0.05.

**Table 4. Results of the Kruskal Wallis Test**

Treatment Group	n	Mean	p value
100% pineapple stem extract	7	24.14	0.000
75 % pineapple stem extract	7	17.29	
50% pineapple stem extract	7	5.00	
10% carbamide peroxide	7	11.57	

Table 4 shows that there were significant differences between the four treatment groups, namely the 50, 75, 100%

pineapple stem extract, and 10% carbamide peroxide as the control group because they had a p value <0.05.

**Table 5. Mann Whitney Post-hoc Test Results**

Treatment Group	Comparison Group	p value
100% pineapple stem extract	75 % pineapple stem extract	0.011
	50% pineapple stem extract	0.001
	10% carbamide peroxide	0.001
75 % pineapple stem extract	50% pineapple stem extract	0.002
	10% carbamide peroxide	0.050
50% pineapple stem extract	10% carbamide peroxide	0.010

From the Mann Whitney post-hoc test, it can be seen that there are groups that have significant differences and there are groups that do not have significant differences. Significant differences can be seen in the comparison between the 100% and 75% concentration of pineapple stem extract group, 100% and 50% concentration of pineapple stem extract group, 100% concentration of pineapple stem extract with 10% carbamide peroxide

control group, 75% concentration of pineapple stem extract. with a concentration of 50%, and pineapple stem extract with a concentration of 50% with a 10% carbamide peroxide control group. There was no significant difference in the comparison between the 75% pineapple stem extract group and the 10% carbamide peroxide control group because they had almost the same average.

**Table 6. The results of the univariate test of tooth surface hardness**

Treatment Group	n	Mean ± SD	Min	Max
100% pineapple stem extract	7	327.70 ± 17.81	297.50	353.00
75 % pineapple stem extract	7	318.73 ± 3.60	313.30	323.06
50% pineapple stem extract	7	326.54 ± 19.19	303.90	347.80
10% carbamide peroxide (control group)	7	316.28 ± 12.88	298.60	335.70

The average tooth surface hardness in the treatment group given the 100% concentration of pineapple stem extract was 327.70 17.81 VHN. The average hardness of the tooth surface in the treatment group given the pineapple stem extract with a concentration of 75% was

318.73 3.60 VHN. The average surface hardness of the teeth in the treatment group given pineapple hump extract with a concentration of 50% was 326.54 19.19 VHN. The average tooth surface hardness in the control group was 10% carbamide peroxide, namely 316.28 12.88 VHN.

**Table 7. Bivariate analysis of tooth surface hardness**

Treatment Group	p
100% pineapple stem extract	0.914
75 % pineapple stem extract	0.639
50% pineapple stem extract	0.145
10% carbamide peroxide	0.881

In the Saphiro Wilk normality test, all variables are normally distributed because they have a p value > 0.05. Based

on the results of these tests, the data processing was continued with the Levene's Test homogeneity with a

significance value ( $p > 0.05$ ). Homogeneity test results obtained  $p$  value = 0.01 ( $p < 0.05$ ), it can be said that the data is not homogeneous so that data transformation is carried out. The data obtained after the transformation were still not homogeneous so that the Kruskal Wallis non-parametric statistical test was carried out.

The results of this study indicated that there were differences in the color of the teeth that became whiter after immersion in samples that had changed color due to extrinsic factors using extracts of pineapple humps with concentrations of 50%, 75%, and 100% as well as 10% carbamide peroxide home bleaching material. In Table 3, it is known that there are significant differences in tooth discoloration between before and after immersion using pineapple stem extract with a concentration of 50%, 75%, 100% and a control group of 10% carbamide peroxide ( $p < 0.05$ ). This study shows that the extract of pineapple hump with a concentration of 50%, 75%, and 100% is effective in whitening teeth that have undergone extrinsic discoloration. The results of this study are in line with the research of Januarizqi *et al.* and Chakravarty *et al.* stated that pineapple fruit is effective in whitening teeth that have undergone extrinsic discoloration. This is because the pineapple extraction process carried out in this study resulted in pineapple extract containing acids and the enzyme bromelain. The acids contained in the extract of pineapple s, namely citric acid, malic acid, and oxalic acid can oxidize substances that cause discoloration of teeth so that teeth look whiter. Bromelain enzyme, which is also found in pineapple extract, can make teeth whiter by removing the protein in the rim, which is where substances that cause tooth

discoloration attach. In this study, the time used for teeth whitening was 4 hours per day for 14 days. This can help in the teeth whitening process because the length of time used and the frequency of using the whitening agent are factors that affect the teeth whitening process. The long enough contact time between the whitening agent and the teeth makes the material used to react longer with the tooth enamel so that the whitening process is also more effective. In line with the research of Marghareta *et al.* who stated that basically the use of home bleaching ingredients is generally seen when applied for 2-6 weeks of use. In addition, the temperature factor also affects the teeth whitening process. In this study, the temperature used for incubation was 37 °C, this helped the teeth whitening process because at 30-40 °C the bromelain enzyme could work optimally, whereas if the temperature was raised to 50 °C, the bromelain enzyme would be denatured or damaged.<sup>8,12,13,14</sup>

Table 4 shows that there are significant differences in all treatment groups. The Post-hoc Mann Whitney test (Table 5) showed a significant difference in the pineapple extract group with a concentration of 100% with a concentration of 50%, 75% and 10% carbamide peroxide ( $p < 0.05$ ). The pineapple extract with a concentration of 100% had the highest average value while the lowest average value was shown by the pineapple extract group with a concentration of 50%. The 100% concentration of pineapple extract produced a greater value for color change than the 50% and 75% concentrations of pineapple stem extract. This is because one of the factors that influence the teeth whitening process is the concentration factor of the whitening agent. The higher the concentration of the bleach, the



greater the resulting color change. The 50% and 75% concentrations of pineapple extract have undergone dilution using distilled water so that the acid and bromelain enzymes contained are less when compared to the 100% pineapple extract.<sup>7,15</sup>

Table 5 shows a significant difference between the 100% concentration of pineapple stem extract and 10% carbamide peroxide ( $p < 0.05$ ). Pineapple stem extract with a concentration of 100% can be more effective in whitening teeth than 10% carbamide peroxide. This is because the 100% concentration of pineapple stem extract is not diluted, besides that the pineapple extract used in this study is used in a liquid preparation while the carbamide peroxide has a gel formulation. Liquid preparations in pineapple extract can more easily penetrate into the tooth surface so that it is more effective in whitening teeth compared to 10% carbamide peroxide.<sup>2</sup>In line with the research of Enny *et al.* who stated that the use of a solution in the form of a solution can more effectively penetrate and absorb into the tooth surface compared to gel form.<sup>15</sup>

Table 5 also shows that there is a significant difference between the pineapple extract group with a concentration of 50% and 10% carbamide peroxide ( $p < 0.05$ ). 10% carbamide peroxide has an average value greater than the 50% concentration of pineapple extract. The 10% carbamide peroxide is more effective in whitening teeth than the 50% concentration of pineapple stem extract because the 10% carbamide peroxide contains carboxypolymethylene (carbopol) polymer which functions as an enhancer of viscosity and adhesion and increases the oxygen release process,

allowing oxygen to react longer with substances that cause coloring. on the teeth. This causes the attachment of carbamide peroxide to the teeth is stronger than the 50% concentration of pineapple extract. The 50% concentration of pineapple extract has undergone dilution using distilled water so that the active substance contained in the 50% concentration of pineapple extract is not as strong as the 100% concentration because dilutions have been carried out.<sup>16</sup>

There is an increasing variation of tooth discoloration in relation to enamel thickness. The teeth used as samples in this study came from different patients so that there were variations in the thickness of the tooth enamel. Another factor that also affects discoloration is the age of the teeth. The age of the owner of the teeth sampled in this study was not known, so the results of the color change were also varied. As you get older, the enamel layer will get thinner due to the thickening of the dentin due to the secondary dentin that is formed. Increasing the thickness of the dentin will cause the teeth to look more yellow, so that the resulting discoloration is smaller than in younger patients.<sup>12,17</sup>

## CONCLUSION

From the research that has been done, it can be concluded that there is a significant difference in tooth color change between before and after treatment using 50%, 75% and 100% concentration of pineapple stem extract and 10% carbamide peroxide and there was no significant difference between the treatment groups with tooth surface hardness.

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## CONFLICT OF INTEREST

Nothing.

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