



THE EFFECT OF HONEY PINEAPPLE JUICE (*Ananas comosus* var. *cayenne*) ON TOOTH ENAMEL HARDNESS

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ABSTRACT

Background: The habit of drinking juice containing high acid in a certain time affects tooth erosion by inducing the dissolvment of enamel hydroxyapatite crystal. Honey pineapple juice is known to have a high acid content and lower pH. However, there have been no reports of honey pineapple juice on tooth enamel hardness. **Aim:** To determine the effect of honey pineapple juice on tooth enamel hardness. **Methods:** This study used an experimental laboratory design with a pre- and post-test group design. Twenty-four post extraction maxillary or mandible premolars were divided into 4 treatment groups; where each group was immersed in honey pineapple juice for 30, 60, 90 and 120 minutes. The pH of honey pineapple juice was determined in the early treatment. The hardness test was carried out before and after the treatment using Vickers Hardness Tester with a load of 100 grams for 15 seconds. Data analysis used Wilcoxon and Kruskal Wallis test. **Results:** The results showed a significant differences in tooth enamel hardness before and after immersion honey pineapple juice for 30 min ($p = 0.028$), 60 min ($p = 0.028$), 90 min ($p = 0.028$), and 120 min ($p = 0.046$). There was no significant difference in the mean of tooth enamel hardness at each immersion times ($p = 0.985$). **Conclusions:** Consumption of honey pineapple juice has an effect on reducing tooth enamel hardness that could be started in a short time consumption.

Key words: Honey pineapple juice, enamel hardness, pH

INTRODUCTION

Tooth enamel is the hardest and strongest tissues among other human body tissues. The mineral component found in tooth enamel is hydroxyapatite ($\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$). This mineral's stability is influenced by the condition of the mouth, for example the mouth's pH. Hydroxyapatite has a critical pH (<5.5). If the oral pH is lower than the critical pH, the hydroxyapatite mineral will dissolve and there will be a progressive interaction between the acid ions and the phosphate group contained in the hydroxyapatite mineral.¹

Erosion of the teeth and dental caries have similar damaging processes, that is the

demineralization of the tooth caused by acid. The acids that caused tooth erosion are not fermented from bacteria in the mouth, while the acids which cause dental caries comes from acids that are the products of food fermentation in the mouth caused by carbohydrate bacteria²

Tooth erosion is a hard tooth tissue damage caused by direct contact between acidic substances to the surface of a tooth. Acid that causes erosion comes from extrinsic, intrinsic and idiopathic factors. Extrinsic factors come from foods and drinks that contain acid, while intrinsic factors come from pregnancy, and digestive disorders such as chronic vomiting. Risk



factors for erosion are acidic juice, soft drinks and carbonated drinks.³

In this era, people's lifestyles are more varied. This can be seen from the consumption of foods and beverages that are more acidic. It is known that pineapple is very acidic, the pH of pineapple is 3.20 - 4.00. There are several types of pineapple fruits, and honey pineapple has more demands due to its sweet and sour tastes and has a high water content so it has fresher quality to be eaten directly or made into juice.^{1,3-5}

The habit of drinking pineapple juice in a certain time can cause the tooth enamel hardness to decrease (tooth erosion), this is due to the high acid content in pineapple.⁶

The aims of this study is to prove the effect of honey pineapple juice (*Ananas comosus var. Cayenne*) on tooth enamel hardness for 30, 60, 90 and 120 minutes.

MATERIAL AND METHODS

Study design

This study used an experimental laboratory design with pretest and post test group design. It was done at Terpadu Laboratory of Diponegoro University Semarang in May to July 2019.

Materials

This study used maxillary or mandibular premolar teeth with fine and intact crowns, honey pineapple juice, and Vickers hardness tester.

Methods

The teeth were cut at the cemento-enamel junction by using a diamond disc, the buccal surface was put face up and placed into a mold that has been filled with self-curing acrylic and made honey pineapple juice. Twenty-four post extraction

maxillary or mandibular premolars were divided into 4 treatment groups.

The pH test of pineapple honey juice was done in the early treatment where each group was immersed in pineapple honey juice for 30, 60, 90 and 120 minutes. The hardness test was carried out before and after the treatment using Vickers Hardness Tester with a load of 100 grams for 15 seconds.

Statistical analysis

This study used the Saphiro Wilk test because the sample size was <50 subjects. The homogeneity test was done by using Lavenne's test in order to see the data variance. In this study the normality and homogeneity test of the tooth enamel hardness data showed an abnormal distribution, thus the data significance of the tooth enamel hardness before and after immersion of honey pineapple juice was tested using the Wilcoxon test. On the other hand, in order to see the significance between different groups differences of tooth enamel hardness showed an abnormal distribution, the Kruskal Wallis test was implemented.

Ethical appearance

Ethical clearance was requested for this research with No. 340 / EC / KEPK / FK-UNDIP / VII / 2019.

RESULTS

Statistical data showed the mean, standard deviation, median and significance of tooth enamel hardness, it can be seen on table 1 and table 2.

1. The difference of tooth enamel hardness before and after it was immersed on honey pineapple juice



Table 1. The difference values of tooth enamel hardness before and after it was immersed on honey pineapple juice

Groups	N	Mean±SD	Median (min-max)	<i>p</i>
Pretest 1	6	261.00±53.05	246.90 (205.40-361.60)	0.028
Post-test 1	6	213.00±59.44	199.10 (165.30-329.30)	
Pretest 2	6	261.58±75.27	269.05(142.40-372.20)	0.028
Post-test 2	6	210.06±49.98	221.15(134.10-279.90)	
Pretest 3	6	257.25±96.89	238.60(125.40-407.20)	0.028
Post-test 3	6	193.20±56.75	192.00(119.60-288.80)	
Pretest 4	6	366.03±121.88	405.65(152.30-462.40)	0.046
Post-test 4	6	280.68±73.59	308.00 (15.,00-344.10)	

*The Wilcoxon test be valid when $p < 0.05$

The data of tooth enamel hardness before and after it was immersed on honey pineapple juice had an abnormal distribution. Then the analysis was continued using Wilcoxon test to determine the differences between two groups of paired data. Wilcoxon test showed a significant difference of tooth enamel

hardness before and after it was immersed with honey pineapple juice for 30, 60, 90 and 120 minutes ($p < 0.05$).

2. The difference of tooth enamel hardness between the various immersion honey pineapple groups.

Table 2. The difference values of tooth enamel hardness between the various immersion honey pineapple groups.

Difference groups	Rerata±SD	Median (min-max)	<i>p</i>
1	48.00±25.54	44.75 (14.90-78.80)	0.985
2	51.48±49.91	46.00 (7.70-143.40)	
3	64.08±45.76	60.45 (5.80-118.50)	
4	85.36±90.95	70.70 (-1.70-216.90)	

*The Kruskal Wallis test be valid when $p < 0.05$

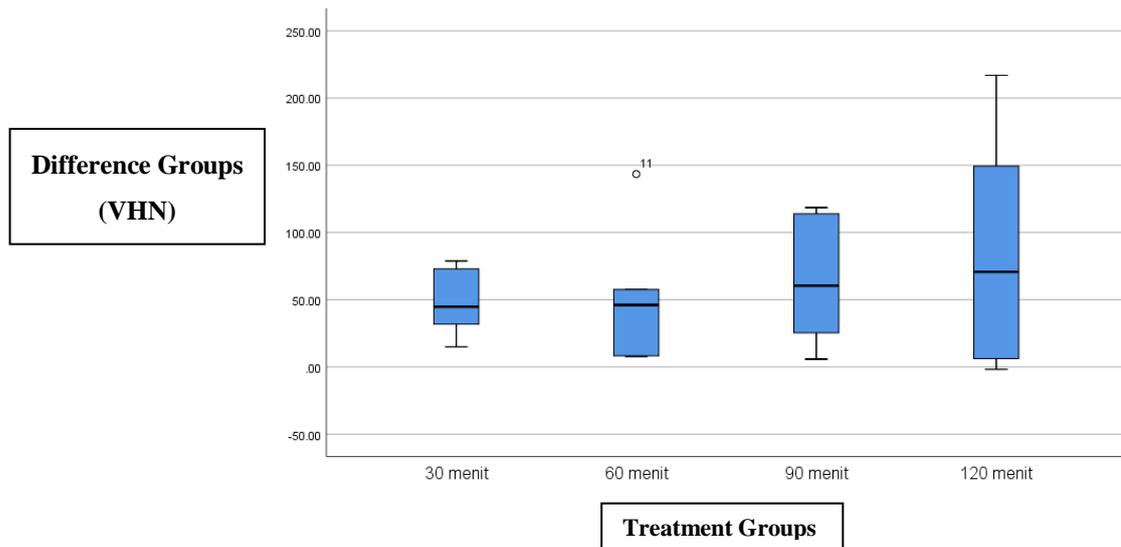


Figure 1. Comparison graph of the mean difference in tooth enamel hardness between the various immersion duration groups

The mean data difference of tooth enamel hardness between the various immersion duration groups were normally distributed and not homogeneous, thus the Kruskal Wallis test could be applied in order to determine the differences in more than two groups. The results which was obtained by Kruskal Wallis test showed $p = 0.985$ ($p > 0.05$), which means there were no significant differences between each time group.

DISCUSSION

The pH of the honey pineapple juice 3.4 and the immersion of samples in each treatment group showed there was a significant decrease of tooth enamel hardness before and after it was immersed in honey pineapple juice for 30, 60, 90 and 120 minutes, and there were no significant difference of tooth enamel hardness between each time group. The process of demineralizing pineapple juice is very fast, this is proven that immersion of sample for 30 minutes has a significant value in decreasing tooth enamel hardness compared

to before immersion and it has no significant difference with longer time of immersion.^{7,8}

The same as previous study that the acid produced by soft drinks of tamarind (pH 3.22) can reduce the surface of enamel hardness.⁸ In the other hand, the other studies showed the bottled lemon juice (pH 3.6) can cause the surface of tooth enamel hardness to change.⁹

This study also illustrated the significant difference of enamel hardness before and after it was immersed in pineapple juice for 25 hours (pH 3.85), but there is no significant difference in the juice of conjoined orange juice (pH 4.87) and artificial saliva (pH 7.57).⁶

Besides pH, email damage can be affected by drink's buffer capacity. Each drinks solution have a concentration and buffer capacity, if it contact the tooth enamel surface, it will cause erosive. The higher of buffer capacity and the greater of erosion that occurs on the tooth surface can increase the demineralization process.⁶

Before immersing in honey pineapple juice, the tooth enamel hardness



has different values because of dental histology, chemical composition of teeth, sample preparation, load measurement and reading error on indentation length (IL).^{1,7}

The remineralization process in the oral cavity is affected by the increase of the mouth's pH and the availability of Ca^{2+} ions and PO_4^{2-} ions. The remineralization process occurs when the pH is greater than the critical pH and the mineral can precipitate. Saliva has a buffer capacity which neutralizes acid in the mouth. The increase in oral pH is affected by salivary buffer capacity. After the pH rises, the ions contained in saliva can repair teeth that are acid-soluble minerals.¹⁰

CONCLUSION

Based on the results of this study, it can be concluded that honey pineapple juice has an effect on decreasing tooth enamel hardness before and after immersion for 30, 60, 90 and 120 minutes, but there is no significant difference in tooth enamel hardness between the various immersion duration groups on honey pineapple juice.

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