

# THE DIFFERENCE OF EFFECTIVENESS BETWEEN STRAWBERRY (*Fragaria x ananassa*) AND HONEY ORANGE (*Citrus sp*) EXTRACTS ON TOOTH DISCOLORATION (IN VITRO STUDY)

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## ABSTRACT

Changing tooth color affects a person's aesthetics. Methods to restore tooth discoloration include the use of agents bleaching. This study aims to understand the differences in the effectiveness of strawberry and honey orange extracts intooth discoloration in vitro. This type of experimental laboratory research used 45 premolar tooth samples divided into 3 groups (50% strawberry extract and 10% carbamide peroxide concentration, 50% honey orange extract and 10% carbamide peroxide concentration and 10% carbamide peroxide concentration). Samples were immersed in coffee solution for 5 days and recorded color with a shade guide, then samples were immersed in the extract of strawberries, honey oranges and carbamide peroxide for 7 days in an incubator, then recorded color again visually with a shade guide. Data analysis used the statistical tests Oneway Anova and Posthoc LSD. The color change of the sample group immersed in strawberry extract with carbamide peroxide resulted in a significant difference ( $p < 0.05$ ). Likewise, the sample group immersed in honey orange extract with carbamide peroxide produced a significant difference ( $p < 0.05$ ), but strawberries and honey oranges did not. there is not significant difference ( $p > 0.05$ ). From the results of the study it can be concluded that the extracts of strawberries and honey oranges were able to increase the discoloration of teeth to become brighter, there was no significant difference between changes in tooth discoloration soaked in strawberry extract and honey orange.

**Keywords:** Strawberry, honey orange, 10% carbamide peroxide, bleaching, extract.

## ABSTRAK

Warna gigi yang berubah mempengaruhi estetika seseorang, metode untuk mengembalikan perubahan warna gigi diantaranya dengan menggunakan bahan *bleaching*. Penelitian ini bertujuan untuk memahami perbedaan efektivitas ekstrak buah stroberi dan jeruk madu dalam perubahan warna gigi secara *in vitro*. Jenis penelitian eksperimental laboratoris menggunakan sampel gigi premolar sebanyak 45 buah dibagi atas 3 kelompok (ekstrak stroberi konsentrasi 50% dan karbamid peroksida konsentrasi 10%, ekstrak jeruk madu konsentrasi 50% dan karbamid peroksida konsentrasi 10% dan karbamid peroksida konsentrasi 10%). Sampel direndam larutan kopi selama 5 hari dan lakukan pencatatan warna dengan *shade guide*, kemudian sampel direndam ekstrak stroberi, jeruk madu dan karbamid peroksida selama 7 hari di dalam inkubator, lalu dilakukan pencatatan warna kembali secara visual dengan *shade guide*. Analisis data memakai uji statistik *Oneway Anova dan Posthoc LSD*. Perubahan warna kelompok sampel direndam ekstrak stroberi dengan karbamid peroksida menghasilkan perbedaan signifikan ( $p < 0,05$ ), begitu pula kelompok sampel yang direndam ekstrak jeruk madu dengan karbamid peroksida menghasilkan perbedaan signifikan ( $p < 0,05$ ), namun stroberi dan jeruk madu tidak ada perbedaan yang signifikan ( $p > 0,05$ ). Dari hasil penelitian dapat disimpulkan bahwa ekstrak stroberi dan jeruk madu mampu meningkatkan perubahan warna gigi menjadi lebih terang, tidak ada perbedaan signifikan antara perubahan perubahan warna gigi yang direndam ekstrak stroberi dan jeruk madu.

**Kata Kunci:** Stroberi, jeruk madu, karbamid peroksida 10%, *bleaching*, ekstrak

## INTRODUCTION

Teeth are the most important part of the oral cavity. The thickness of the enamel and dentin affects the color of the teeth. Normal permanent

teeth are grayish white, grayish yellow and tend to be yellowish-gray (Grossman et al, 2013). Clean teeth with the color can white stevoke a person's confidence in appearance (Ibeyemi and Taiwo, 2011).

In the era of globalization, tooth change is an aesthetic that most people pay attention to

(Suwakbur, 2015). Tooth discoloration is the change in tooth color (Sundoro, 2005). Tooth discoloration can be in any tooth and in any part or it can involve the deepest tooth structure (Tarigan, Gita, 2012). There are two factors that can change the color of the teeth, namely the internal and external factors. The extraordinary factor on the surface of tooth enamel is usually caused by the stain of tobacco, coffee, tea, and other beverages, while the internal factor is the stain that is present after the enamel and dentin parts are caused by the accumulation or incorporation of *stain* tetracycline (Grossman et al., 2013).

Whitening enamel and preventing coral build up are benefits found in the strawberry (*Fragaria x ananassa*). The discoloration of the enamel can be caused by eletic acid which is able to bind to the dye and release electrons that can bind. Malic acid from the carboxylic acid group can cause a whitening effect by oxidizing the enamel to neutral (Ariana et al, 2016). Tomato fruit is not as effective in whitening teeth compared to strawberry juice which contains eletic and malic acid, according to Suwakbur (2015). The theory says that if the pH of the material is getting smaller, the material is increasingly acidic and can easily erode the surface of the enamel, tomatoes have a pH of 4 while strawberries have a pH of 3. According to Yuniarti et al. (2016), the use of 405 teeth whitening agents results in a decrease in strength and thickness. enamel and tooth strength.

Honey orange (*Citrus sp*) is a type of orange that is widely consumed. This plant contains citric acid to whiten teeth. Citric acid binds to the dye and releases electrons which can cause discoloration of the enamel. According to research by Rochmah dd (2014), honey oranges have the potential to whiten tooth enamel that changes color. A 2.5% concentration of honey lemon juice can whiten tooth enamel that has undergone discoloration for 45 minutes. In Price's research, Sedarous Hiltz (2000) showed that *in-of ice* 35%bleaching hydrogen peroxide had a pH of 3.67-6.53 and honey oranges had a pH ranging from  $3.6 \pm 0.1$  and  $3.7 \pm 0.1$  (Asmawati, Aulia, 2016). According to Reksodiputra (2004) natural tooth whitening ingredients for strawberries and hydrogen peroxide *in-of ice* have a pH that is almost the same as honey orange with a concentration of 2.5%, namely  $\pm 3$  (Rochman et al., 2014).

## RESEARCH METHODS

This research was a laboratory experimental study at the North Sumatra Regional Government's ASPETRI Medicinal Plant Research and

Development Laboratory and the Medan Regional Health Laboratory from December 2020 to February 2021. The research sample used 45 post- extraction premolar teeth which were grouped into 3 groups. Each group consisted of 15 samples (Gay, LR and Diehl, PL. 1992).

Group 1 was a group of teeth soaked in 50% concentration of strawberry extract and 10% carbamide peroxide mixed with it. Group 2 was a group of teeth soaked in 50% concentration of honey orange extract and mixed with carbamide peroxide at a concentration of 10%. The samples that had been prepared were soaked in coffee solution for 5 days and all the teeth were recorded using a *classic vitapan shade guide* under the same lighting and observed by three observers to observe the color of the teeth after soaking the coffee. Each sample is inserted into a tube that has been numbered. Each sample was immersed in the extract solution. Group 1 was the immersion group of 50% concentration of strawberry extract and 10% carbamide peroxide concentration, Group 2 was the immersion group of 50% concentration of honey orange extract and 10% carbamide peroxide concentration, and Group 3 was the immersion group of 10% carbamide peroxide concentration. Then all tubes were put into an incubator with a temperature of  $37^{\circ}\text{C}$  for 7 days. All samples were stirred twice a day and then immersed in saline solution for 24 hours. Color recording was carried out for each sample using a *shade guide* underlighting the same, seen and observed by three observers in each of the 3 groups of solutions. Color assessment is done by assessing the *values* colorsorted from the lightest color to the darkest color, from B1 = 1, A1 = 2, B2 = 3, D2 = 4, A2 = 5, C1 = 6, C2 = 7, D4 = 8, A3 = 9, D3 = 10, B3 = 11, A3,5 = 12, B4 = 13, C3 = 14, A4 = 15, C4 = 16.

## RESEARCH RESULTS

Based on the results of the study, the average *value* colorin group I after soaking coffee was  $6.93 \pm 0.53$  and after soaking 50% strawberry fruit extract with 10% carbamide peroxide was  $2.04 \pm 0.03$ . The average *value* colorin group II after soaking coffee was  $6.98 \pm 0.528$  and after soaking 50% honey orange fruit extract with 10% carbamide peroxide was  $2.16 \pm 0.010$ . The average *value* colorin group III after soaking coffee was  $9.09 \pm 0.68$  and after soaking 10% carbamide peroxide was  $6.44 \pm 0.94$ .

Table 3.1 Average *values* colorafter soaking coffee and after soaking in 10% carbamide peroxide, honey orange extract with 10% carbamide peroxide, and strawberry extract with

## 10% carbamide peroxide

Group		Observers			–
		I	II	III	
I	After soaking coffee	7,13	6,33	7,33	6,93 ±0,53
	After soaking strawberry extract 50% with carbamid peroxide 10%	2,01	2,06	2,06	2,04 ±0,03
II	After soaking coffee	6,67	7,20	7,07	6,98 ±0,28
	After soaking honey orange fruit extract 50% with carbamid peroxide 10%	2,13	2,07	2,27	2,16 ±0,10
III	After soaking coffee	9,87	8,67	8,73	9,09 ±0,68
	After immersion with carbamid peroxide 10%	7,53	5,87	5,93	6,44 ±0,94

Based on the results of the statistical test *oneway* ANOVA, the *p value* = 0.048 ( $p < 0.05$ ). From these results, the data revealed that there were effectivity Three significant strawberry fruit extract, citrus honey and 10% carbamide peroxide in tooth discoloration *in vitro*.

Then, the results of this statistical test were followed by the test *posthoc* LSD to see the a concentration of 10-22% is effective for teeth whitening. Using teeth whitening agents can cause gingival irritation and tooth sensitivity (Suwakbur, 2015). In addition, the excess carbamide peroxide which is often unstable and at high concentrations can be mutagenic, causing many researchers to look for natural ingredients that can function like carbamide peroxide.

In this study, researchers used two natural ingredients, namely strawberries and honey citrus fruit which were formed in the form of an extract dosage with a concentration of 50% and 10% carbamide peroxide as a positive control in the form of a gel dosage. The study compared the results of the color change that occurred between a mixture of 50% strawberry fruit extract with

difference in the effectiveness of the extracts of strawberries, honey oranges and 10% carbamide peroxide into tooth discoloration *in vitro*. Based on the test, it was *posthoc* LSD found that there was a significant difference in the effectiveness of tooth discoloration between 10% carbamide peroxide and 50% honey orange extract ( $p = 0.034$ ), and 10% carbamide peroxide with 50% strawberry extract ( $p = 0.030$ ). However, the results of this test also showed that there was no significant difference in the effectiveness of tooth discoloration between 50% honey orange extract and 50% strawberry extract ( $p = 0.953$ ).

Table 3.2 The effectiveness of extracts of strawberries, honey oranges, carbamide peroxide 10% discoloration of teeth in *in vitro*

Group	<i>p value</i>
Strawberry extract 50%	
Honey orange fruit extract 50%	0,048*
Carbamid peroxide 10%	

Description : \* There is effectiveness

## DISCUSSION

The results of soaking samples with coffee solution in this study showed that coffee can cause discoloration of teeth to turn yellow and as an indication for teeth whitening. Apart from being easy to find, coffee is also often consumed by people as a daily drink. This is what makes coffee the right ingredient because it has been proven that coffee makes teeth darker. According to Barney et al (2011), generally extrinsic color changes occur due to food, drinks and cigarettes, including drinks such as tea, coffee and other drinks (Yunita et al., 2017).

Carbamide peroxide as a *home bleaching* with

10% carbamide peroxide, a mixture of 50% honey orange extract with 10% carbamide peroxide and only 10% carbamide peroxide.

Based on the results of the study, it was found that 50% strawberry fruit extract and 50% honey orange extract could whiten discolored teeth. The results of the statistical test *oneway* ANOVA indicated that there was a significant difference in the effectiveness of the extracts of strawberries and honey oranges on tooth discoloration *in vitro* ( $p = 0.048$ ;  $p < 0.05$ ). Supported by the results of the test *posthoc* LSD which states that there is a significant difference in the effectiveness of tooth discoloration between 10% carbamide peroxide and 50% honey orange extract ( $p = 0.034$ ), and 10%

carbamide peroxide with 50% strawberry extract ( $p = 0.030$ ). However, the results of this test also showed that there was no significant difference in the effectiveness of tooth discoloration between 50% honey orange extract and 50% strawberry extract ( $p = 0.953$ ). The results of this study conducted by Yuniarti & Murniati (2016). The results of this study are also in line with research by Afrida (2020) which states that strawberry juice has the ability to whiten teeth better when compared to tomato juice. Likewise, at one, three and five hours after soaking, tomato juice when compared to strawberry juice, strawberry juice is more effective in whitening the color of the teeth (Suwakbur, 2015).

Based on the results of the study, it was shown that a mixture of 50% strawberry fruit extract with 10% carbamide peroxide was proven to be more able to whiten the color of teeth that had been soaked in coffee compared to other test materials. Meanwhile, a mixture of honey citrus fruit with 10% carbamide peroxide is better than 10% carbamide peroxide alone. The results of this study were not the same as the research conducted by Juwita Margaretha, et al (2009) who used strawberry fruit paste and 10% carbamide peroxide gel, which showed that there was no difference between teeth soaked in 10% carbamide peroxide gel compared to strawberries (Suwakbur, 2015).

The difference in the final results of the color change that occurred in the three groups in this study could be due to differences in the preparation of the test materials used, namely the difference in molecular weight of strawberries and honey oranges in the extract which was smaller than the molecular weight of 10% carbamide peroxide in the form of a gel. The test results show that the molecular weight of carbamide peroxide is 94.1 by the *Consumer Protection Directorate General and the European Commission Health* showing that the molecular weight of carbamide peroxide is 94.1 (Suwakbur, 2015). The smaller molecular weight for penetration into the enamel and dentin is better than for materials with a larger molecular weight. This research was proven by Richard J. Miron *et. al*, (2015). Research by Stacey *et al* (2011) states that the acid content of *ellagic (Ellagic acid)* strawberries has a low molecular weight of *polyethylenimine* (PEI) so that it is easier to penetrate, especially in use for drugs (Suwakbur, 2015).

According to Nikhala et al (2018), strawberries are a natural agent *bleaching* that can be used in everyday life. Strawberry fruit contains *elegic acid* which can help whiten teeth (Suwakbur, 2015). Strawberry fruit not only contains *elegic acid* but also contains *malic acid* in it which has one of the supporting factors that occur in teeth whitening. (Marcella et al., 2014).

The mechanism of *malic acid* and *acid elegat* in eliminating dye that is by destructive double bond in the conjugation bond, splitting the conjugation bond by way of oxidizing part of other chemicals present in the conjugation bond (Afrida, 2020).

The degree of acidity (pH) also affects the whitening process of teeth. The results of pH measurements in this study know the pH of the strawberry extract with a concentration of 50% and a concentration of 10% carbamide peroxide is 3, while the pH of the honey orange extract with a concentration of 50% and 10% carbamide peroxide concentration is 5 and the pH of 10% carbamide peroxide is 5.5. This degree of acidity is considered important in the process of dissolving enamel so that it erodes (Yunita et al., 2016). The hardness of the tooth enamel surface has decreased due to the acidic substances in low pH fruits that are easier to process damage to the tooth surface on the enamel, so that the color of the teeth becomes whiter (Adhani et al., 2015).

## CONCLUSION

conclusion from the results of the study was that the extracts of strawberries and honey oranges were able to increase the color of teeth to become lighter, but there was no significant difference between the effectiveness of the extracts of strawberries and honey oranges on tooth discoloration *in vitro*.

## SUGGESTIONS

1. Further research is needed to determine the effect of whitening strawberries on teeth *in vivo*.
2. Further research is needed to compare the whitening effects of strawberries with other fruits.

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