



Comparison of Tomato Fruit Juice (*Lycopersicon esculentum* Mill.) and Cherry Tomato Fruit Juice (*Solanum lycopersicum*) on Tooth Discoloration in the Teeth Bleaching Process

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ABSTRACT

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Background: Tooth discoloration is one of the problems that makes many people feel uncomfortable when talking or smiling. Tooth discoloration can be treated with *bleaching*. Natural ingredients can be used as a safer and more affordable alternative to tooth *bleaching*. Tomato fruit (*Lycopersicon esculentum* Mill.) and cherry tomatoes (*Solanum lycopersicum*) contain hydrogen peroxide that can damage dye molecules and peroxidase enzymes that can increase the speed of hydrogen peroxide in reducing color so that it causes a whitening effect on teeth.

Objective: To determine the comparison of tomato fruit juice (*Lycopersicon esculentum* Mill.) and cherry tomato juice (*Solanum lycopersicum*) on tooth discoloration in the process of tooth *bleaching*.

Methods: This research is laboratory experimental research with *pre-test post-test design* method. The number of research samples was 27 teeth permanent incisive both upper and lower jaws soaked in tomato fruit juice (*Lycopersicon esculentum* Mill.) and cherry tomato juice (*Solanum lycopersicum*) for 1, 3, 5 hours. The study was conducted by measuring the difference in tooth color changes before and after soaking in tomato fruit juice (*Lycopersicon esculentum* Mill.) and cherry tomato juice (*Solanum lycopersicum*) using Vita Easyshade V.

Results: All sample groups produced color changes after being soaked in tomato fruit juice (*Lycopersicon esculentum* Mill.) and cherry tomato juice (*Solanum lycopersicum*). The values of paired T-test results of *light*, *chrome*, and *hue* showed that there were significant differences in tooth color ($\text{sig} < 0.05$).

Conclusion: Immersion of teeth in tomato fruit juice (*Lycopersicon esculentum* Mill.) and cherry tomato fruit juice (*Solanum lycopersicum*) can cause discoloration of teeth. The highest color change in the 5-hour immersion group in tomato fruit juice (*Lycopersicon esculentum* Mill.) and cherry tomato fruit juice (*Solanum lycopersicum*) for *Lightness*, *Chroma* and *Hue* values.

KEYWORDS:

Tomato Juice, Soaking, Tooth Color, *Bleaching*

INTRODUCTION

Dental aesthetic treatments have recently been in great demand by the public and have almost become a necessity. Aesthetics in dentistry is the harmonious integrity of several oral physiological functions with the same emphasis

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so as to produce ideal dentition through restorations with color, shape, structure, and function to achieve optimal health and durability. The purpose of aesthetic treatment is to produce a more beautiful appearance but still looks natural.¹

The public is now more familiar with aesthetic dentistry through various media and advertisements.² Surveys show that 28-34% of patients like white teeth and agree to dental *bleaching* treatment.³

Many factors influence tooth discoloration so that the success rate for removing it varies. Tooth discoloration is divided into extrinsic and intrinsic.⁴ Extrinsic stains occur due to food and beverages such as coffee, tea, and tobacco. Whereas, intrinsic stains are located inside the teeth and can

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only be accessed by dental *bleaching*.^{4,5}

Bleaching is a procedure for bleaching teeth that are discolored until they are close to the original color of the teeth with a chemical repair process that aims to restore the aesthetics of one's teeth. *Bleaching* procedures can be done *in office bleaching* (done in the clinic by the dentist directly) or *home bleaching* (done at home under the supervision of the dentist), and can be done internally for non-vital teeth or externally for vital teeth.⁶ Materials commonly used as *bleaching* are materials that contain peroxide.⁷

Hydrogen peroxide has the disadvantage of being unstable and mutagenic at very high concentrations. Therefore, the use of hydrogen peroxide needs to be considered to avoid side effects that can affect the dental *bleaching* process.⁶ Natural ingredients can be used as a safer and more affordable alternative to dental *bleaching*.⁸

Tomato fruit (*Lycopersicon esculentum* Mill.) and tomatoes cherry (*Solanum lycopersicum*) naturally No strange thing Again for life daily and its benefits No can in doubt again, some big Indonesian people use tomato as adder spice cooking, drinks, ingredients industry, even normal used for facial beauty. ⁹ Fruit tomato is source of protein, fat, vitamins, and minerals. Ingredients found in fruit tomato includes solanine alkaloids (0.007%), saponins, acids folate, acid malic acid citrate, biflavonoids, protein, fat, sugar (fructose, glucose), adenine, trigoneline , choline , tomatotoin , minerals (Ca, Mg, P, K, Na, Fe, sulfur and chlorine), vitamins (B1, B2, B6, C, E, niacin), histamine , and lycopene. ¹⁰ Fruit tomato (*Lycopersicon esculentum* Mill.) contains β -

carotene, provitamin A carotenoids and acid ascorbic acid ascorbic acid (vitamin C) is substances that are effective contain superoxide, hydrogen peroxide, *singlet oxygen* and other free radicals. The results of several studies show that the content of hydrogen peroxide and peroxidase enzymes in tomatoes are effective compounds for whitening teeth. ⁷

MATERIALS AND METHODS

The type of this research is a laboratory experimental study using samples of permanent one and two incisor teeth both upper and lower jaws. The 27 samples were divided into 3 groups with each group consisting of 9 samples in both immersion in tomato fruit juice and cherry tomato juice. The division of sample groups was carried out based on variations in soaking time in TW variant tomato fruit juice, namely for 1 hour, 3 hours and 5 hours. After soaking, the samples were measured using VITA *Easysshade V*.

RESULTS

The average measurement results of *light*, *chrome*, and *hue* values before and after soaking the samples for 1 hour, 3 hours, and 5 hours can be seen in Table 1.

Samples were subjected to paired t test after it was found that the data were normally distributed and homogeneous. The results of calculations using the paired t test obtained all color values of *light*, *chrome*, and *hue* $p < 0.05$, so it can be concluded that there is a significant difference in color changes in permanent one and two incisor teeth both upper and lower jaws before and after soaking in tomato fruit juice.

Table 1. Average Yield of Tomato Fruit Juice Samples

Time	Average	Color		
		L	C	H
1 Hour	Before soaking	23.667	16.311	0.656
	After soaking	24.222	13.956	-0.889
3 Hours	Before soaking	21.833	15.322	0.289
	After soaking	23.622	12.956	-0.389
5 Hours	Before soaking	19.522	16.344	0.644
	After soaking	22.456	12.944	-0.133

Table 2. Average Yield of Cherry Tomato Juice Sample

Time	Average	Color		
		L	C	H
1 Hour	Before soaking	23.380	15,940	0.670
	After soaking	22,444	12,460	-0.700
3 Hours	Before soaking	23,150	16,370	1,240
	After soaking	25,730	13,000	-0.500
5 Hours	Before soaking	19.540	18,000	1,640
	After soaking	26,230	14,100	-1,150

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DISCUSSION

Tooth discoloration is one of the problems that makes many people feel uncomfortable when speaking or smiling, and is an aesthetic issue that has a considerable psychological impact.³ Factors that can affect external discoloration are usually related to poor oral hygiene, existing restorations, gingival bleeding, plaque accumulation, eating habits, beverages, or the presence of chromogenic microorganisms. Whereas, intrinsic discoloration factors are caused by *deeper/superficial* internal stains or *enamel* defects.⁴

External *bleaching* is a way to whiten discolored teeth due to extrinsic factors with a chemical repair process to restore the aesthetic function of the teeth. The use of high concentrations of chemicals as *bleaching* agents has adverse side effects. As a result of these negative effects, many researchers began to look for natural ingredients that function like *bleaching* agents in general. According to research by Lumuhu et al. (2016), a natural ingredient proven to whiten teeth is tomato and stated that tomato juice is more effective in whitening teeth compared to apple juice and 10% carbamide peroxide.¹¹

In this study, TW tomato (*Lycopersicon esculentum* Mill.) fruit juice was used, which is commonly used in foods such as salads, *sandwiches*, and burgers. This type of TW tomato is commonly found in local markets.¹² This study is a bleaching technique by immersing teeth into tomato fruit juice at 100% concentration for 1 hour, 3 hours, and 5 hours. Color measurements of permanent one or two incisor tooth samples were taken before and after soaking in tomato fruit juice using VITA *Easysshade* V.

Vitamin C or ascorbic acid found in tomatoes is a substance that effectively contains hydrogen peroxide which is a strong oxidizing compound.¹³ According to Ibrahim K et al. (2015), hydrogen peroxide compounds and peroxidase enzymes accumulate in the *pericarp* of tomato fruit when it is red. Hydrogen peroxide can penetrate the structural layer of *enamel* or dentin which produces free radicals that are quite reactive. These free radicals will damage organic molecules (stains) on the teeth to reach neutral. Hydrogen peroxide is able to oxidize various kinds of colored organic and inorganic compounds, so that teeth become brighter. The peroxidase enzyme in tomatoes can increase the speed of hydrogen peroxide in reducing color.^{13,14}

Based on the average L value (Table 2), it can be seen that the color change with the highest average value increase is in the 5-hour group when compared to other groups, so that samples that have been soaked in tomato fruit juice for 5 hours experience a brighter color change when compared to other immersion groups. The difference seen in the immersion of tomato fruit juice for 5 hours can be interpreted that the immersion group with a longer time is likely to produce a whiter tooth color change. This is in line with Lumuhu's research (2016), which states that all teeth soaked in tomato

juice, apple juice and 10% carbamide peroxide show changes in color observation values every day of measurement and the values are getting higher, so it can be said that every day the teeth are getting whiter.¹¹ Supported based on the theory according to Hilton et al. (2016) and Grossman (2021), state that discoloration of teeth in the *bleaching* process can be influenced by factors such as surface cleanliness, concentration, temperature, pH, time, and patient age.^{4,17}

In another research from Septiva AP, et al (2009), for now influence giving tomato fruit juice to change in tooth color in the whitening process in vitro, using 30 pieces soaked teeth in fruit juice tomatoes and distilled water during three days. The results shows that in immersion in tomato juice during three day proven capable increase total change in tooth color in a way meaningful compared to with group control and administration of fruit juice tomato during three days can whitening teeth.¹⁸

According to Wira, et al (2019), change in tooth color which in soak in strawberry fruit juice and tomato fruit juice show result that there is no difference after soaking for 1 day. But there are significant differences in groups immersion after 3 and 5 days.¹⁹

According to Novianti, et al (2020), in their research show that patch characterization / patch volume show results that all formulas have thickness range 100-300 μm ; pH in range 4-5; power stand fold >300 times; and can attached to the specimen tooth during more from 3 hours and fruit juice tomato can used as material teeth whitening.²⁰

According to Hendarmin AL, et al (2021), stated that the implementation patch / patch volume tomato juice causes increased teeth brightness. Patch /volume containing 65% tomato juice significantly improved the brightness of stained teeth ($P < 0.05$). SEM analysis showed less enamel erosion with the 65% tomato juice patch compared to the 12% hydrogen peroxide patch. The tomato juice patch effectively improved the brightness of teeth while minimizing demineralization.²¹

In the research Laksmana, SS, et al (2022), using two tens four post premolar teeth extraction given exposure home bleaching materials. Sample shared into 4 groups with each consisting of of 6 samples. Group A was exposed hydrogen bleaching agent peroxide 3%, group B hydrogen 3% peroxide with additional 30% tomato juice, group C hydrogen 3% peroxide with additional 75% tomato juice, and group D was exposed to commercial home bleaching ingredients opalescence whitening gel PF 10%. Every group exposed 8 hours/ day for 7 days. Changes color measured before and after exposure use colorimeter, shows results that fourth group can whiten teeth. And there are influence adding fruit juice tomatoes on hydrogen bleaching agent 3% peroxide against change color brighter teeth.²²

The results of data analysis using the paired t test in Table 3 state that there are significant differences ($p < 0.05$) in the measurement of the L, C, and H values of each sample

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time group before and after being soaked in tomato fruit juice. However, this is different from Salsabila et al. (2021), who conducted research on the effect of tomato fruit (*Solanum lycopersicum*) and lemon fruit (*Citrus limon L*) as natural teeth whitening ingredients for 1 hour, 3 hours, and 5 hours with the results of the study obtained that each time had an insignificant difference in measurement values, the possibility of differences in these results due to differences in the methods

used, namely the Vitapan Classical shade guide which was carried out by two people with a *blinding* system. The insignificant measurement value is explained by the law of light propagation.⁸ But this research is supported by research by Sumantri et al. (2017), which states that there is a significant difference in tooth color before and after treatment with tomato extract and miswak wood extract.⁹

Table 3. Paired T test for Tomato Fruit Juice Samples

Time	Color	Mean ± SD	p-Value*
1 Hour	<i>Light Before - Light After</i>	-0.61 ± 0.70	0.031*
	<i>Chrome Before - Chrome After</i>	2.35 ± 2.66	0.029*
	<i>Hue Before - Hue After</i>	1.54 ± 0.77	0.000*
3 Hours	<i>Light Before - Light After</i>	-1.78 ± 0.91	0.000*
	<i>Chrome Before - Chrome After</i>	2.36 ± 2.53	0.023*
	<i>Hue Before - Hue After</i>	0.67 ± 0.74	0.026*
5 Hours	<i>Light Before - Light After</i>	-2.93 ± 1.42	0.000*
	<i>Chrome Before - Chrome After</i>	3.40 ± 2.63	0.005*
	<i>Hue Before - Hue After</i>	0.77 ± 0.20	0.000*

*Paired T Test: $p < 0.05$: significant

Table 4. Paired T-test for Cherry Tomato Juice Samples

Time	Color	Mean ± SD	p-Value*
1 Hour	<i>Light Before - Light After</i>	22,24± 0.17	0.086*
	<i>Chrome Before - Chrome After</i>	12.46±0.10	0.001*
	<i>Hue Before - Hue After</i>	-0,70± 0.12	0.001*
	<i>Light Before - Light After</i>	25,73 ±0.22	0.001*
3 Hours	<i>Chrome Before - Chrome After</i>	13.00 ±0.13	0.001*
	<i>Hue Before - Hue After</i>	-0,52 ± 0.06	0.008*
	<i>Light Before - Light After</i>	26.23±0.08	0.008*
5 Hours	<i>Chrome Before - Chrome After</i>	14.10 ±0.18	0.001*
	<i>Hue Before - Hue After</i>	-1,15 ± 0.13	0.001*

*Paired T Test: $p < 0.05$: significant

CONCLUSIONS

Immersion of teeth in tomato fruit juice (*Lycopersicon esculentum* Mill.) and cherry tomato fruit juice (*Solanum lycopersicum*) can cause discoloration of the teeth. The highest

color change in the 5-hour immersion group in tomato fruit juice (*Lycopersicon esculentum* Mill.) and cherry tomato fruit juice (*Solanum lycopersicum*) for *Lightness*, *Chroma* and *Hue* values. Tooth discoloration occurs due to hydrogen peroxide

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content, the influence of peroxidase enzymes, acidic properties and ascorbic acid content.

SUGGESTION

The researcher realizes that this research still needs improvement, development, and expects several things, namely the need for further research using other natural *bleaching* materials to see the effect on teeth that occurs, the need for further research with other test equipment to see the results of discoloration that occurs in teeth, and the need for further research on the effective acidity level of tomato fruit (*Lycopersicon esculentum* Mill.).

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