

Original Research

The effect of tomato juice (*Lycopersicon esculentum* Mill.) on the natural tooth-whitening process

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ABSTRACT:

Background: The problem of tooth discoloration can be overcome by bleaching. Natural ingredients can be used as an alternative to teeth whitening that is safer and more affordable. Tomato (*Lycopersicon esculentum* Mill.) contains hydrogen peroxide which can damage dye molecules and the peroxidase enzyme which can increase the speed of hydrogen peroxide in reducing color, causing a whitening effect on teeth. **Material & Methods:** The research sample consisted of 27 first and second permanent incisors, both maxillary and mandibular, which were soaked in tomato juice (*Lycopersicon esculentum* Mill.) with a duration of 1 hour, 3 hours and 5 hours. The study was conducted by measuring differences in tooth color after soaking using Vita Easyshade V. **Results:** The value of the light, chrome, and hue paired t-test results showed a significant difference in tooth color (sig < 0.05). **Conclusion:** Tomato juice (*Lycopersicon esculentum* Mill.) used for 1 hour, 3 hours and 5 hours can affect tooth discoloration.

Keywords: Color Change, Tomato Juice, Tooth-whitening Process

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INTRODUCTION

Dental aesthetic care is currently in great demand by the public and has almost become a necessity. Aesthetics in dentistry is the harmonious integration of several physiological functions of the oral cavity with the same emphasis on restoration of 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 look natural.¹ People are now more familiar with aesthetic dentistry through various media and advertisements.² Surveys show that 28–34% of patients prefer white teeth and agree to tooth bleaching treatment.³ Many factors can affect tooth discoloration, so the speed or success rate for relieving it varies. Tooth discoloration can be classified into extrinsic and intrinsic.⁴ Extrinsic stains occur due to foods and beverages such as coffee, tea, and tobacco. Meanwhile, intrinsic stains are located inside the teeth and can only be accessed by teeth whitening.^{4,5}

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

Hydrogen peroxide has the disadvantage that it is unstable and is a mutagen at very high concentrations. Therefore, the use of hydrogen peroxide needs to be considered to avoid side effects that can affect the teeth whitening process. 6 Natural ingredients can be used as a safer and affordable alternative to teeth whitening.⁸

Tomatoes (*Lycopersicon esculentum* Mill.) are certainly not foreign to everyday life and their benefits cannot be doubted. Most Indonesians use

tomatoes as an addition to cooking spices, drinks, industrial ingredients, and are even commonly used for facial beauty.⁹ Tomatoes are a source of protein, fat, vitamins, and minerals. The content contained in tomatoes includes solanine alkaloids (0.007%), saponins, folic acid, malic acid, citric acid, biflavonoids, proteins, fats, sugars (fructose, glucose), adenine, trigonelin, choline, tomatin, minerals (Ca, Mg, P, K, Na, Fe, sulfur and chlorine), vitamins (B1, B2, B6, C, E, niacin), histamine, and lycopene.¹⁰ Tomato (*Lycopersicon esculentum* Mill.) contains β -carotene, provitamin A carotenoids and ascorbic acid. Ascorbic acid (vitamin C) is a substance that effectively contains superoxide, hydrogen peroxide, singlet oxygen and other free radicals. The results of several studies show that the content of hydrogen peroxide and the enzyme peroxidase in tomatoes is an effective compound for whitening teeth.⁷

MATERIALS AND METHODS

This type of research is a laboratory experimental study using samples of the first and second permanent incisors, both maxillary and mandibular. There were 27 samples which were divided into 3 groups with each group consisting of 9 samples. The distribution of sample groups was carried out based on the variation of the immersion time in the TW variant of tomato fruit juice, namely for 1 hour, 3 hours and 5

hours. After immersion, the samples were measured using VITA Easyshade V.

Before conducting the research, the TW tomatoes that will be used in this study were tested at the Laboratory of the Department of Food Science and Technology, Bogor Agricultural University, in March 2022 to see the content of ascorbic acid (vitamin C).

RESULTS

The content test was carried out using a sample in the form of TW tomato fruit extract with the measuring instrument used was spectrophotometry. The test results are shown in Table 1.

Based on the results in Table 1, it was found that the content of ascorbic acid (vitamin C) in the TW tomatoes used in this study was 63.13 mg/100g. The results of measuring the average values of light, chrome, and hue before and after soaking the samples for 1 hour, 3 hours, and 5 hours can be seen in Table 2.

The sample was carried out by paired T test after it was obtained that the data were normally distributed and homogeneous. The results of calculations using a paired t test obtained all values of light, chrome, and hue color $p < 0.05$, so it can be concluded that there is a significant difference in color changes in the permanent first and second incisors, both maxillary and mandibular, before and after immersion in tomato juice.

Table 1. Ascorbic acid (vitamin C) test results

No.	Example Type	Unit	Analysis Results	Methods
1	Fresh Tomatoes	mg/100g	63.13	Spektrofotometri

Table 2. Average sample yield

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 Hour	Before soaking	21.833	15.322	0.289
	After soaking	23.622	12.956	-0.389
5 Hour	Before soaking	19.522	16.344	0.644
	After soaking	22.456	12.944	-0.133

DISCUSSION

Tooth discoloration is one of the problems that makes many people feel uncomfortable when talking or smiling, and is an aesthetic problem 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, drinking, or presence of chromogenic microorganisms. Meanwhile, the intrinsic discoloration factor is caused by deeper/superficial internal stains or enamel defects.⁴

Whiten back discolored teeth due to extrinsic factors with a chemical repair process to restore the aesthetic function of the teeth. The use of chemicals with high concentrations as bleaching agents has adverse side effects. As a result of these negative impacts, many

researchers have begun to look for natural ingredients that function like bleaching materials in general. According to research by Lumuhu et al. (2016), a natural ingredient that has been proven to whiten teeth is tomatoes and states that tomato juice is more effective in whitening teeth compared to apple juice and 10% carbamide peroxide.¹¹

In this study, tomato juice TW (*Lycopersicon esculentum* Mill.) is used, which is usually used in foods such as salads, sandwiches, and burgers. Many types of TW tomatoes are found in local markets.¹² This research is a whitening technique by immersing the teeth into tomato juice at a concentration of 100% for 1 hour, 3 hours, and 5 hours. Measurement of the color of the first or second permanent incisor samples was carried out before and

after immersion in tomato juice using VITA Easyshade V.

Vitamin C or ascorbic acid contained 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 and peroxidase enzymes accumulate in the pericarp of tomatoes when they turn red. Hydrogen peroxide can penetrate the layers of the enamel or dentin structure, producing quite reactive free radicals. These free radicals will damage organic molecules (stains) on the teeth to achieve neutrality. Hydrogen peroxide is capable of oxidizing a wide variety of colored organic and inorganic compounds, resulting in brighter teeth. Peroxidase enzymes in tomatoes can increase the speed of hydrogen peroxide in reducing color.^{13,14}

The results of the research that has been carried out, found that there are differences in tooth color that occur after soaking using tomato juice (*Lycopersicon esculentum* Mill.) for 1 hour, 3 hours and 5 hours. This indicates that tomato juice contains ascorbic acid (vitamin C), which is a substance that effectively contains hydrogen peroxide and peroxide enzymes. In line with the research conducted by Mala et al. (2017), that the content of ascorbic acid tomatoes in various concentrations, namely at concentrations of 30%, 70%, and 100%, the results of tomato extracts with various concentrations were effective in teeth whitening.⁷ Supported by the results of research literature studies of Abdullah N and Munadirah (2021), tomatoes contain hydrogen peroxide which is equivalent to teeth whitening using chemical compounds that are often used, and the peroxidase enzyme content in tomatoes can also provide a natural bleaching effect.¹⁵

The results of this study showed that there were changes in the values of L, C, and H in each sample group. The increase in the value of L color occurred in all sample groups immersed in tomato juice. This indicates that the color of the teeth becomes brighter because, based on the theory, according to Aschheim, KW (2015), the value of L can be used to see the dark and bright color of the teeth, where a high L indicates

that the teeth are brightly colored while a low L indicates that the teeth are dark.¹⁶

Based on the average value of L (Table 2), it can be seen that the color change with the highest increase in the average value was found in the 5-hour group when compared to other groups, so that the sample that had been soaked in tomato juice for 5 hours experienced a color change to become lighter, bright when compared to other immersion groups. The difference seen in tomato juice immersion for 5 hours can be interpreted as the longer immersion group is likely to produce whiter teeth discoloration. This is in line with Lumuhu's research (2016), which states that all teeth soaked in tomato juice, apple juice and 10% carbamide peroxide showed a change in the color observation value every day of measurement and the value was getting higher, so it can be said that every day the teeth are getting whiter.¹¹ Supported by the theory, according to Hilton et al. (2016) and Grossman (2021), that discoloration of teeth during the bleaching process can be influenced by factors such as surface cleanliness, concentration, temperature, pH, time, and patient age.^{4,17}

The results of data analysis using a paired t-test in Table 3 stated that there were significant differences ($p < 0.05$) in the measurement of L, C, and H values for each sample time group before and after soaking in tomato juice. However, this is different from Salsabila et al. (2021), who conducted a study on the effect of tomatoes (*Solanum lycopersicum*) and lemons (*Citrus limon* L) as natural ingredients for teeth whitening for 1 hour, 3 hours, and 5 hours with the results obtained each time having different measurement values that did not. It is possible that the difference in the results is due to the difference in the method used, namely the Vitapan Classical shade guide which was carried out by two people with a blinding system. This insignificant measurement value is explained by the law of light propagation.⁸ However, this study is supported by the research of Sumantri et al. (2017), which stated that there was a significant difference in tooth color before and after the treatment of tomato extract and siwak wood extract.⁹

Table 3. Paired t-test

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

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

CONCLUSION

Based on the research that has been done, regarding the effect of tomato juice (*Lycopersicon esculentum*

Mill.) on changes in tooth color in the teeth bleaching process, it was concluded that there was an effect of changing tooth color after soaking with tomato juice

(*Lycopersicon esculentum* Mill.) and showed the highest color change. in the 5 hour group. This is caused by hydrogen peroxide, peroxidase enzymes and a long soaking time.

The researcher realizes that this research still requires refinement, development, and hopes for several things. Meanwhile, further research needs to be done using other natural bleaching materials to see the effect on the teeth that occurs. Further research needs to be done with other test equipment to see the results of discoloration that occurs in teeth, and further research is needed on the effective acidity level of tomato (*Lycopersicon esculentum* Mill.).

REFERENCES

1. Wahjuni S, Setyowati O, Gofur NRP, Faisyah SA. The Making Of Snap-on Smile With Acetyl Thermoplastic Resin To Improve The Aesthetics And Function In Case Of Tooth Loss. *Journal of Vocational Health Studies*. 202;04136-145.
2. Nugraha PY, Darmi AR. Tingkat Fluor Dalam Air Minum dan Pengobatan Fluorosis Berdasarkan Indeks Thylstrup Fejerskov. *Interdental: Jurnal Kedokteran Gigi*. 2018;14(2):35-40.
3. Istanto IE. Tatalaksana Perawatan Diskolorasi Intrinsik Dengan Perawatan Saluran Akar Dan Metode Walking Bleach. *JKGT*. 2020;2(1):44-47.
4. Hilton TJ, Ferracane JL, Brome JC. *Summitt's Fundamentals of Operative Dentistry: A Contemporary Approach*. 4th Ed. China: Quintessence Publishing Co Inc. 2016.
5. Stewart M, Bagby M. *Clinical aspects of dental materials: theory, practice and cases*. 5th Ed. China: Wolters Kluwer. 2018.
6. Riani MD, dkk. Pengaruh Aplikasi Bahan Pemutih Gigi Karbamid Peroksida 10% dan Hidrogen Peroksida 6% secara Home Bleaching terhadap Kekerasan Permukaan Email Gigi. *Jurnal Kesehatan Andalas*. 2015; 4(2):346-52.
7. Mala HF, Arti DWK, Aprillia Z. Efektivitas Asam Askorbat Dalam Ekstrak Buah Tomat (*Lycopersicon esculentum* Mill.) Terhadap Pemutihan Gigi Dengan Konsentrasi 30%, 70%, Dan 100%. *Prosiding Seminar Nasional Publikasi Hasil-Hasil Penelitian Dan Pengabdian Masyarakat*. 2017;1(1):172-176.
8. Salsabila S, Putra MR, Wijaya S, Mulyanti R. Pengaruh Tomat dan Buah Jeruk Nipis Sebagai Bahan Pemutih Alami Gigi. *Jurnal Ilmiah Kesehatan Sandi Husada (JIKSH)*. 2021;10(1):229-235.
9. Sumantri D, Devi NS, Djafri D. Perbandingan Penggunaan Bahan Pemutih Alami Ekstrak Buah Tomat (*Lycopersicon Esculentum* Mill) Dengan Ekstrak Kayu Siwak (*Salvadora Persica*) Terhadap Perbedaan Warna Gigi. *Cakradonya Dent J*. 2017;9(2):79-82.
10. Usman F. Tomat untuk Pencegahan Penyakit Jantung. *Jurnal Kesehatan Published by Poltekkes Ternate*. 2020;13(1):31-7.
11. Lumuhu EFS, Kaseke MM, Parengkuan WG. Perbedaan Efektivitas Jus Tomat (*Lycopersicon esculentum* Mill.) dan Jus Apel (*Mallus sylvestris* Mill.) sebagai Bahan Alami Pemutih Gigi. *Jurnal e-GiGi (eG)*. 2016;4(2):83-9.
12. Pratiwi GC. Kajian Penggunaan Kemasan Karton dan Peti Terhadap Mutu Buah Tomat dalam Transportasi Darat. [Skripsi]. Bogor: FATETA, 2012.
13. Mulky IH, Rania N, Kasuma N, Tsabitha S F. The Influence of Tomato Juice as an Alternative Treatment to Whiten the Teeth. *Indonesian Scholars Journal*. 2014;1(1):1-2.
14. Ibrahim K, Kawengian SES, Gunawan PN. Pengaruh Pemberian Jus Buah Tomat (*Lycopersicon Esculentum* Mill.) terhadap Pembersihan Stain Ekstrinsik pada Resin Komposit. *Jurnal e-GiGi (eG)*. 2015;3(2):449-53.
15. Abdullah N, Munadirah. Buah Tomat (*Solanum lycopersicum*) Sebagai Bahan Pemutih Gigi Alam. *Media Kesehatan Gigi*. 2021;20(1):47.
16. Aschheim KW. *Esthetic Dentistry: A Clinical Approach To Techniques And Materials*. Third Edition. St. Louis, Missouri: Elsevier Mosby Inc. 2015: 39.
17. Gopikrishna V. *Grossman's Endodontic Practice*. 14th Ed. New Delhi: Wolters Kluwer Health; 2021:455-64.