DENTINO
JURNAL KEDOKTERAN GIGI
VOL X. No 2. SEPTEMBER 2025

THE EFFECT OF HONEY PINEAPPLE JUICE (*Ananas conosus var. cayenne*) ON DISCOLORATION OF COMPOSITE RESIN DUE TO COFFEE IMMERSION

Saskya Aldina Nur Amalina,[1)] Nadia Hardini,[1)] Lusiana Batubara,[2)] Brigitta Natania Renata Purnomo[1)]
[1)]Dentistry Study Program, Faculty of Medicine, Diponegoro University, Semarang, Central Java, Indonesia
[2)]Medicine Study Program, Faculty of Medicine, Diponegoro University, Semarang, Central Java, Indonesia

ABSTRACT
Background: *Discoloration of the composite resin can be cleaned using chemicals. However, chemicals are still being debated because they have some side effects. This has led researchers to look for natural materials that can be used to clean composite resins. Honey pineapple contains organic acids and the enzyme bromelain which can be used to clean teeth.* ***Objectives:*** *This study aims to determine the effect of honey pineapple juice on the color change of composite resin due to coffee immersion after soaking honey pineapple juice for 1, 3, and 5 days.* ***Methods****: This type of research is an experimental laboratory with a pre test - post test group design. The research data were tested using paired t test and one way ANOVA test.* ***Results:*** *The results showed that there were differences in the color change of the composite resin due to coffee immersion after soaking honey pineapple juice for 1, 3, and 5 days.* ***Conclusions:*** *There is an effect of honey pineapple juice on the color change of the composite resin due to coffee immersion and there are differences in the color change of the composite resin due to coffee immersion after soaking honey pineapple juice for 1, 3, and 5 days. The highest color change occurred in immersion for 5 days.*

Keywords: *Coffee Immersion, Discoloration of composite resin, Honey pineapple juice*

***Correspondence**: Nadia Hardini; Dentistry Study Program, Diponegoro University, Jln. Prof. Soedarto, S.H., Tembalang, Semarang, Central Java, Indonesia; E-mail: hardininadia@gmail.com

INTRODUCTION

Composite resin is a restoration material that is widely used and popular in dentistry because it has good aesthetic properties and adequate strength.[1,2,3] However, when composite resin is exposed to the environment of the oral cavity, color changes may occur. Extrinsic and intrinsic factors can also cause these color changes. While intrinsic factors are connected to the components of the composite resin itself, extrinsic effects result from the absorption of colors from external sources including soft drinks, carbonated beverages, red wine, tea, and coffee.[3,4]

Coffee consumption now currently a lifestyle for Indonesian people. Coffee is widely consumed because of its unique taste and benefits for reducing fatigue. On the other hand, coffee also has disadvantages due to the content of chlorogenic acid and tannins which can cause color changes in composite resin.[5,6]

Color changes in composite resin can be overcome by cleaning using chemicals like carbamide peroxide and hydrogen peroxide. However, the use of these chemicals is still being debated because it can have side effects and has several disadvantages.[7-10] Several safer and more affordable alternative ingredients such as citrus fruits, tomatoes, strawberries and pineapples have been shown to reduce discoloration of human teeth and some of them have also been shown to reduce discoloration of composite resin.[7,11- 13]

Pineapple is a tropical fruit that is widely distributed in Indonesia and has an increase in consumption needs every year.[14] Honey pineapple (Ananas comosus var. cayenne) is one type of pineapple that is have a good demand in the public because it has a sweeter taste.[14,15] Previous research conducted by Kevinda et al. (2017) stated that the content of pineapple fruit which includes the bromelain enzyme, as well as organic acids including oxalic acid, malic acid, and citric acid can play a role in cleaning coffee stains on human teeth.[13,16-18] However, the effect of honey pineapple juice has never been studied before on discoloration of composite resin due to coffee soaking.

Therefore, the researcher is interested in knowing the effect of honey pineapple juice (Ananas comosus var. cayenne) on the color change of composite resin due to coffee immersion after immersion in honey pineapple juice (Ananas comosus var. cayenne) for 1, 3, and 5 days.

MATERIALS AND METHODS

This research was conducted at the Dental Preclinical Laboratory, Biomedical Laboratory, and the Integrated Laboratory at Diponegoro University, Semarang. (Ethics No. 004/KEPK/FK UNDIP/II/2022). Laboratory experimental research was used in this study with a pre-test - post-test group design that utilized 27 nanofil type composite resins as research samples. The samples were molded in a circle with a diameter of 10mm and a height of 2mm, irradiated for 20 seconds using a light curing unit then finished and polished on the upper surface using a disc-type soflex bur for 20 seconds at each level of roughness. The surface of the sample that was not finished and polished was coated with clear nail polish. Each sample was labeled as an identity on the surface of the sample surface container.

20 ml of coffee was prepared for immersion of the samples and incubated at 37^{o}C (standard room temperature) with a changes of the solution every 24 hours in 7 days. This was done to show extrinsic stains on the surface of the samples. After 7 days, chroma meter was used to measure the initial color.

Honey pineapple juice was made by cutting the pineapple into smaller pieces and then 200 grams of honey pineapple fruit is blended using a blender with a concentration of 100%. Next, the pH of honey pineapple juice was measured using a pH meter. The samples that had a same initial color measurements were soaked in 5ml of honey pineapple juice for 1, 3, and 5 day at standarad room temperature.

Measurement of color changes was carried out objectively using a chroma meter (CR400 Konica Minolta, Japan) with the CIELAB system. Color changes (ΔE) were gained from the L*, a*, b* values in the pretest and posttest groups and then calculated using the formula.

$\Delta E = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$. [19]

Notes :

ΔE : Color changes

ΔL* : Brightness changes

Δa* : Red to green changes

Δb* : Yellow to blue changes

Data analysis began with a normality test using the Shapiro-Wilk test (n<50) and continued with a homogeneity test. Data analysis was carried out using paired t tests ($p < 0.05$) to determine the difference in the average of each sample group before and after treatment. Data analysis was continued with the One Way ANOVA (significance of $p < 0.05$) to determine the difference in color change before and after treatment between groups and continued with a post hoc test using the Least Significant Difference (LSD) test.

RESULTS

Based on the research results, the average color change in the nanofil composite resin was obtained after soaking in honey pineapple juice for 1, 3 and 5 days as in table 1. The highest color change (ΔE) was seen in treatment group III (soaking for 5 days) with an average of 7.14 and the lowest color change was seen in treatment group I (soaking for 1 day) with an average of 2.57.

To prove the significant color changes in each group, statistical tests were conducted. The results of the Shapiro-Wilk normality test and Levene's Homogeneity test showed that all treatment groups had normal and homogeneous data with a significance value of > 0.05. All data in this study met the requirements to be continued with the paired t test and One Way ANOVA test.

Table 1. Average Results of Color Change in Nanofil Composite Resin

Group	Mean						
	Pre-test			*Post-test*			
	L*	**a***	**b***	**L***	**a***	**b***	**ΔE**
I	70,95	6,37	17,64	72,58	5,54	15,84	2,57
II	71,35	6,25	17	74,65	5,22	13,55	4,88
III	71,48	6,31	18,45	76,7	5,07	13,74	7,14

Based on table 2, the results of the paired t test in all groups have significant L*, a*, and b* values with p values <0.05. This shows that there is a significant difference in the average color change in the samples before and after being given the honey pineapple juice immersion treatment.

Based on table 3, the results of the one-way ANOVA test were obtained in all treatment groups with a significance value of 0.001 ($p < 0.05$). This indicates a significant difference in the average color change in all treatment groups.

Table 2. *Paired T Test* Results of Color Changes in Nanofil Composite Resin

Group		Mean ± SD		
	Value	***Pre-test***	***Post-test***	***p***
Treatment Group I	L*	70,95	72,58	0,003
	a*	6,37	5,54	0,003
	b*	17,64	15,84	0,012
Treatment Group II	L*	71,35	74,65	0,001
	a*	6,25	5,22	0,001
	b*	17	13,55	0,000
Treatment Group III	L*	71,48	76,7	0,000
	a*	6,31	5,07	0,005
	b*	18,45	13,74	0,000

Paired T Test Sig : p < 0,05

Table 3. *One Way ANOVA* Results of Color Changes in Nanofil Composite Resin

Color Changes (ΔE)	***P***
Intergroup	0,001

One Way ANOVA Test Sig : p< 0,05

	Treatment Group I	Treatment Group II	Treatment Group III
Treatment Group I		0,046	0,000
Treatment Group II	0,046		0,03
Treatment Group III	0,000	0,03	

The results of further tests using the post hoc LSD test showed that all comparisons between the 2 groups had significant values with p values <0.05. This indicates that there is a difference in the color change of the composite resin due to coffee immersion after immersion in honey pineapple juice (Ananas comosus var. cayenne) for 1, 3, and 5 days.

DISCUSSION

In this study, the color change of composite resin can be triggered by chlorogenic acid and tannin contained in coffee.[20] Chlorogenic acid can damage the surface of the composite resin by degrading the polymer bond so that the release of monomers is accompanied by the release of filler particles in the composite resin.[20,21] The release of filler particles that occurs, causes an increase in the empty space between the polymer matrix which facilitates the process of liquid absorption into the composite resin. Tannin as a coloring agent in coffee will be easily absorbed, causing the surface color of the composite resin to become blackish brown.[20-23]

The results of the paired t test showed a significant color change towards brighter in each treatment group. This shows that there is an effect of honey pineapple juice (Ananas comosus var. Cayenne) on the color change of the composite resin due to coffee immersion. The color change towards brighter is indicated by an increase in brightness value (L *), a decrease in red-green color value (a *), and a decrease in yellow-blue color value (b *).[24]

Brighter surface color of resin composite is a result from honey pineapple juice immersion. Honey pineapple contains citric acid, malic acid and oxalic acid as an organic acid which can help to clean the stain on composite resin, resulting in a brighter color.[25,26] In this study, The acid content in pineapple have a low pH around 3.7-4.0[13,18] The acid in pineapple can penetrate into the composite resin matrix and release electrons through an oxidation

process that causes the surface to degrade from the chromatic agent, resulting in a brighter surface color of the composite resin.[15] Citric acid is an acid that dominates around 78% in pineapple.[25] Research of Evica et al. (2018) states that citric acid can produce brighter colors and clean stains on composite resin through the oxidation process by damaging the dye molecules attached to the surface of the composite resin.[11] The bromelain enzyme in pineapple have a functions to break down the protein layer attached to the pellicle formed on the tooth surface, thereby helping to remove the adhesion of agents that cause discoloration.[13,27]

The results of the One Way ANOVA test showed a significant color change in all treatment groups. Continued with the LSD post hoc test which stated that there was a significant difference between groups 1 and 2, groups 1 and 3, groups 2 and 3. This means that there is a difference in the color change of the composite resin due to coffee immersion after soaking in honey pineapple juice (Ananas comosus var. cayenne) for 1, 3, and 5 days. The lowest to highest color changes (ΔE) respectively started from the honey pineapple juice immersion group for 1, 3, and 5 days. Table 1 shows that the ΔE value increases with the length of soaking time of pineapple honey juice. The results of this study mean that the difference in the length of soaking time of pineapple honey juice affects the brightness level of the composite resin color. In line with the research of Kholidina et al. (2014) which states that the longer the contact time of the composite resin with the cleaning agent, the brighter the color change that occurs in the composite resin. This is because the longer the contact time with the cleaning agent, the more acid reacts in breaking the bonds of the agent that causes the color change, resulting in the surface color of the composite resin becoming brighter.[11,28,26,29]

There is an effect of honey pineapple juice on the color change of composite resin due to coffee immersion and there is a difference in the color change of composite resin due to coffee immersion after soaking in honey pineapple juice for 1, 3, and 5 days.

REFERENCES

1. Shabrina N D V. Gambaran Penggunaan Bahan Amalgam, Resin Komposit dan Glass Ionomer Cement (GIC) Di Rumah Sakit Gigi dan Mulut Unsyiah Pada Bulan Juli-Desember 2014. J Caninus Denstistry.2016:1(4):9–11.
2. Sumolang M. Gambaran Penggunaan Resin Komposit dan Semen Ionomer Kaca Sebagai Bahan Restorasi di Poli Gigi Rumah Sakit Gunung Maria Tomohon Tahun 2012. e-GIGI. 2013;1(2).
3. Barutcigil Ç, Yildiz M. Intrinsic and extrinsic discoloration of dimethacrylate and silorane based composites. J Dent. 2012;40(SUPPL. 1):57–63.
4. Hidayatsyah I, Nofika R. Pengaruh Minuman Berwarna dan Minuman Berwarna Berkarbonasi Terhadap Perubahan Warna Resin Komposit Nanohybrid. Andalas dent J. 2020;8(2)
5. International Coffee Organization (ICO). (2020)
6. Sirang S V, Anindita PS, Juliatri . Pengaruh kopi arabika terhadap perubahan warna resin komposit hybrid. e-GIGI. 2017;5(1).
7. Ibrahim K, Kawengian SES, Gunawan PN. Pengaruh Pemberian Jus Buah Tomat (Lycopersicon Esculentum Mill.) Terhadap Pembersihan Stain Ekstrinsik Pada Resin Komposit. e-GIGI. 2015;3(2).
8. ADA Council on Scientific Affairs. Tooth whitening/bleaching: treatment considerations for dentists and their patients. Chicago ADA [Internet].2019; 1–12
9. Riani MD, Oenzil F, Kasuma N. Pengaruh Aplikasi Bahan Pemutih Gigi Karbamid Peroksida 10% dan Hidrogen Peroksida 6% secara Home Bleaching terhadap Kekerasan Permukaan Email Gigi. J Kesehat Andalas. 2015;4(2):346–52.
10. Moghadam FV, Majidinia S, Chasteen J, Ghavamnasiri M. The degree of color change, rebound effect and sensitivity of bleached teeth associated with at-home and power bleaching techniques: A randomized clinical trial. Eur J Dent. 2013;7(4):405–11.
11. Makasenda EF., Wicaksono DA, Khoman JA. Perubahan Warna Resin Komposit pada Perendaman Larutan Cuka (Asam Asetat) dan Jeruk Nipis (Citrus arantifolia). e-GIGI. 2018;6(2).
12. Juanita, M., Rovani, C., Mattulada, I., Tanumihardja, M. 2019. Potential of 10% strawberry gel (fragaria x annanassea) as an alternative bleaching agent for extrinsic discoloration of composite resin: an in vitro study. Journal of Dentomaxillofacial Science. 2019; 4(1): 22-27.
13. Kevinda J, Isyana E, Sherli D. Perbandingan Efektivitas Jus Buah Nanas (Ananas Comosus) dengan Jus Buah Stroberi (Fragaria xannanassea) sebagai Bahan Alami Pemutih Gigi Eksternal. Dentino J Kedokt Gigi. 2017;I(1):73–7.
14. Astoko E. Konsep Pengembangan Agribisnis Nanas (Ananas Comosus L. Merr.) Di Kabupaten Kediri Provinsi Jawa Timur. Habitat. 2019;30(3):111–22.
15. Putri ND, Sutanto A, Noor R. Perbandingan Hasil Pertumbuhan Nanas Queen dan Nanas Madu (Cayenne) Sebagai Sumber Belajar Biologi Berupa Panduan Praktikum Materi Pertumbuhan. Pros Semin Nas Pendidik 2017. 2017;117–22.
16. Hadiati S, Indriyani NL. Budidaya nenas. Balai Penelitian Tanaman Buah Tropika, Pusat Penelitian dan Pengembangan Holtikultuta. Badan Penelitian dan Pengembangan Pertanian. 2018. 24 p.
17. Silaban I, Rahmanisa S. Pengaruh Enzim Bromelin Buah Nanas (Ananas comosusL.) terhadap Awal Kehamilan. Majority. 2016;5(4):80–5.
18. FDA/Center for Food Safety & Applied Nutrition. Approximate pH of Foods and Food Products. Dep Heal Hum Serv. 2018:1–13

19. Irwandana PW, Kristanti Y, Daradjati S. Perbedaan perubahan warna pada bahan restorasi giomer dan kompomer pasca aplikasi bahan bleaching berbahan dasar hidrogen peroksida 40 % sebagai bahan in office bleaching. J Kedokt Gigi. 2016;7(2):145–50.
20. Hananta, sean ostita., Sutrisno Gatot. AD. Perbedaan Perubahan Warna Pada Permukaan Resin Komposit Nanofiller Dan Nanohybrid Setelah Perendaman Kopi. Fak Kedokt Gigi Univ Indones [Internet]. 2015; Available from: http://lib.ui.ac.id/naskahringkas/2015-08/S-Sean Otista Hananta
21. Chumairo SM, R DMC, Nugroho R, Gigi FK, Jember U, Biomedik B, et al. Pengaruh Kebiasaan Minum Kopi Robusta (Coffea robusta) terhadap Perubahan Warna pada Restorasi Resin Resin komposit nanofiller (The Effect of Robusta Coffee (Coffea robusta) Drinking Habits on Nanofiller Composite Resin Discoloration). Artik Ilm Has Penelit Mhs. 2014;1–5.
22. Kristanti Y. Perubahan warna resin komposit nanohibrida akibat perendaman dalam larutan kopi dengan kadar gula yang berbeda. J PDGI. 2016;65(1):26–30.
23. Borges ALS, Costa AKF, Saavedra GSFA. Color stability of composites : effect of immersion media COLOR STABILITY OF COMPOSITES : EFFECT OF IMMERSION MEDIA Department of Dental Materials and Prosthodontics , Universidade Department of Restorative Dentistry , Universidade. 2014.
24. Pan Q, Westland S. Tooth color and whitening – digital technologies. J Dent. 2018 April;74:S42–46.
25. Puspita CP. Kualitas Fruitghurt Hasil Fermentasi Limbah Nanas (Ananas Comosus) Dengan Penambahan Lactobacillus bulgaricus. J Publ. 2012;1:1–14.
26. Istibsyaroh. Perubahan warna resin komposit nanofiller setelah perendaman dalam minuman susu fermentasi (Penelitian in vitro). Jember: Fakultas Kedokteran Gigi Universitas Jember; 2015.
27. Prihastuti KO. Pengaruh Ekstrak Buah Nanas (Ananas comosus (L .) Merr) Terhadap Penurunan Stain Ekstrinsik Kopi Pada Anasir Gigi Tiruan. PSKG Universitas Muhammadiyah Surakarta. 2020.
28. Kholidina H, Astrid Y, Sefty H. Perubahan Warna Resin Komposit Mikrohibrid Setelah Pemutihan Dengan Hidrogen Peroksida 15%. Cakradonya Dent J. 2014; 6(2):678-744
29. Utami DR, Kusuma ARP, Anggarani W. Pengaruh Lama Aplikasi Dan Waktu Perendaman Gigi Dengan Jus Buah Pir Terhadap Perubahan Warna Dan Kekerasan Mikro. ODONTO Dent J. 2016;3(2):111.