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### White Pomegranate Extract Gel's Efficacy as A Teeth-Whitening Agent

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#### ABSTRACT

Tooth discoloration is one of the most common concerns associated with dental appearance or cosmetic issues. Teeth whitening is one of the conservative procedures that may be utilized to overcome tooth discoloration (bleaching). Utilizing natural bleaching agents is a safer, less expensive, and more accessible option. Malic acid (malic acid) and elegat acid (allegic acid) obtained from fruits can be used to whiten teeth. White pomegranate (*Punica granatum L.*) is one of these all-natural components. The purpose of this research was to evaluate the efficacy of white pomegranate extract gel as a bleaching agent against tooth discoloration. This research utilizes an experimental laboratory design. There were 24 mandibular second premolars utilized as samples. All teeth were submerged for seven days in the coffee solution. Utilizing spectrophotometry, tooth discoloration was measured. After being soaked in a coffee solution and then a white pomegranate extract gel, the item was dried. Group 1: teeth soaked in white pomegranate extract gel with a concentration of 70%. Group 2: teeth soaked in white pomegranate extract gel with a concentration of 80%. Group 3: teeth soaked in white pomegranate extract gel with a concentration of 90%. Group 4: 10% carbamide peroxide gel as a positive control. Each specimen was immersed for 56 hours. Using a spectrophotometer, tooth discoloration was assessed following immersion in white pomegranate gel extract and carbamide peroxide gel. Based on the results of the LSD test, the % group was determined to be the most effective as a teeth whitening agent. White pomegranate extract gel has an influence on tooth discoloration and tooth whitening attempts.

**Keywords:** tooth discoloration, white pomegranate, bleaching.

#### Introduction

Teeth, including tooth color, are an essential cosmetic feature for patients. In the United Kingdom, 28 percent of individuals are unsatisfied with the color of their teeth, whereas, in the United States, 34 percent of adults are displeased with the color of their natural teeth (1). According to the 2018 Basic Health Research (Riskesdas) in Indonesia, 45.3% of dental issues were attributed to damaged teeth, cavities or dental caries, and tooth discoloration or tooth stains caused by smoking.

The color of a person's teeth depends on the thickness of the enamel, the color of the dentin, and the color of the pulp. Extrinsic and intrinsic causes can induce tooth discoloration owing to the accumulation of stains, commonly known as tooth discoloration. Tooth discoloration caused by extrinsic causes changes in the tooth's outer surface. Tooth discoloration results from the adhesion of the pellicle to the tooth enamel in the form of germs, food, and drinks. Tea, coffee, red wine, cigarettes, and narcotics are beverages that can cause extrinsic stains (2).

According to research by Hasan et al. (2014), sixty percent of those who consume coffee more than twice daily have discolored teeth (3). A coffee drink is a beverage created from chlorogenic acid, caffeine, and tannins found in coffee bean extract. In coffee beverages, tannins are one of the chromogenic substances that contain a dye. Accumulation of tannin components in coffee can enhance the likelihood of brownish discoloration on all tooth

surfaces (4).

One of the conservative treatments that can be used in overcoming the problem of tooth discoloration is by doing teeth whitening (bleaching). Bleaching is a process of re-whitening teeth that have changed color 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 (1,5). Teeth whitening procedures can be done using chemicals or natural ingredients that contain ellagic acid. Teeth bleaching chemicals often used are hydrogen peroxide or carbamide peroxide in the form of gels or toothpaste with varying concentrations (6). Many controversies regarding the safety of vital teeth bleaching procedures and peroxide-based products have been accepted by the American Dental Association (ADA) as safe and effective agents. The effects caused by these chemical bleaching agents are considered in developing an alternative material for whitening teeth with safer natural ingredients (7,8). The effects caused by these chemical bleaching agents are considered in developing an alternative material for whitening teeth with safer natural ingredients (6). Using natural materials is an alternative that is safer, cheaper, and easier to obtain than chemical materials. In addition to the chemical materials hydrogen peroxide and carbamide peroxide, natural ingredients from fruits containing malic acid and allergic acid can be used to whiten teeth (9). One natural ingredient that contains allergic acid is white pomegranate (*Punica granatum L.*)(6).

White pomegranate has many benefits, from the skin of the roots to the fruit's flesh. The content of allergic acid in white pomegranate is a potent oxidizing agent that can function as a natural teeth whitening agent (6). Based on the description above, researchers are interested in researching the effectiveness of white pomegranate extract gel (*Punica granatum L.*) as a tooth whitening agent on the tooth enamel surface.

## Method

This study is a laboratory experiment employing a simple experimental design with a pre-post test-only control group design. Based on Federer's formula, the sample utilized consisted of 24 samples divided into 4 groups of 6 samples each. The inclusion criteria for the sample were post-extraction teeth (the teeth that had been detached from their sockets were in good condition and intact, the crowns of the mandibular second premolars were still intact, and the crowns lacked caries, the crowns lacked anomalies, and the crowns were not fractured). All samples were appropriate. Meeting inclusion criteria were numbered 1 through 24. On 24 samples, from the root to the cervical portion of the mandibular second premolar, transparent white nail polish was applied to the roots to prevent the coffee solution from penetrating the dentinal tubules. The sample's root surface must then be evaluated. Before being measured using a spectrophotometer, the sample is sealed with duct tape to regulate the light on the spectrophotometer, as black duct tape has a value of 0 (dark). The sample is steeped in robusta coffee for seven days before spectrophotometry is used to evaluate the change in tooth color.



Figure 1. Research sample

The white pomegranate extract was made by peeling the white pomegranate and separated from the fruit skin, mashed by means of a blender plus 96% ethanol solvent then stirred and the container was left closed for 5 days, then filtered using filter paper and a Buchner funnel, then the process was carried out. evaporation. Carbopol 940 as much as 1.2 g was dispersed and put into a sterile container, then distilled water was added, crushed quickly until a clear solution was formed. Add 10% NaOH solution, grinded slowly until a gel mass was formed (Gel mass 1). Nipagin was dissolved in 0.3g of 96% ethanol and then put into gel mass 1. Take the ethanol extract of white

pomegranate dissolved with 5.7 g of 96% ethanol and add propylene glycol then mixed and stirred. After that, it is mixed into the gel mass 1 and stirred until homogeneous (10).

After soaking with robusta coffee, the next step is to soak the sample in a white pomegranate extract gel. Samples 1-6 soaked in white pomegranate extract gel with a concentration of 70%, samples 7-12 soaked in white pomegranate extract gel with a concentration of 80%, samples 13-18 were soaked in white pomegranate extract gel with a concentration of 90%, samples 19-24 gel 10% carbamide peroxide as a positive control. Each sample was soaked for 56 hours. Tooth discoloration was measured again using a spectrophotometer after immersion in white pomegranate gel extract and carbamide peroxide gel.

## Results

The results showed that the average absorbance value of the sample before and after soaking the coffee solution and the white pomegranate extract gel soaking treatment can be seen in table 1.

**Table 1.** Average and standard deviation of absorbance values.

Group	Initial value	Coffee soaking post	Treatment post	Standard deviation
Pomegranate extract gel 70%	0.3614	0.6110	0.3460	0.2650
<b>Pomegranate extract gel 80%</b>	0.3621	0.6021	0.3329	0.2692
<b>Pomegranate extract gel 90%</b>	0.3640	0.5951	0.3189	0.2762
Carbamide peroxide 10% <b>(positive control)</b>	0.3614	0.6061	0.2933	0.3128

Table 1 shows that after the treatment by soaking the white pomegranate extract gel, the absorbance value in the sample changed from the absorbance value of Robusta coffee immersion. The absorbance value of 10% carbamide peroxide gel of 0.2933 was used as a positive control which aims to determine that the white pomegranate extract gel has the ability to whiten the tooth enamel surface. The smallest post-treatment absorbance value was in the pomegranate extract gel soaking group with a concentration of 90% and this absorbance value was close to the absorbance value of the positive control. While the group that has the highest absorbance value in the sample is in the group with a concentration of 70%.

The results of the Shapiro Wilk normality test obtained  $p$  value  $> 0.05$ , the data was normally distributed. Also, the Levene homogeneity test  $p > 0.05$  variance of homogeneous data. The one way ANOVA test showed a significant value for the initial absorbance value ( $p = 0.829$ ) and a significant value for the absorbance value after soaking coffee ( $p = 0.170$ ) based on the one way ANOVA test, this value showed that the group did not have a significant difference because the significant value was  $p > 0.05$ . . Meanwhile, the significant value of post-treatment absorbance of white pomegranate gel was 0.000 ( $p < 0.05$ ) so it was concluded that there was a significant difference after treatment using white pomegranate extract gel with concentrations of 70%, 80% and 90% as a teeth whitening agent. on the tooth enamel surface. The LSD test results showed that the 70% and 80% concentration groups had sig values ( $p = 0.002$ ), in the 70% and 90% concentration groups there were sig values ( $p = 0.000$ ), and in the 80% and 90% concentration groups there were sig values ( $p = 0.001$ ). The sig value between the 70% white pomegranate extract gel group and the 90% white pomegranate extract gel group was 0.000. This value means that there is a significant difference between the 70% white pomegranate extract gel group and the 90% white pomegranate extract gel group which is very small from the other concentration groups ( $p = 0.000$ ). Based on these results, it can be concluded that the highest effectiveness is in the group with a concentration of 90%.

## Discussion

The use of the white pomegranate extract gel resulted in a lighter-colored transformation. The one-way ANOVA statistical test findings revealed significant differences between samples following coffee soaking or discoloration and those treated with white pomegranate gel. It demonstrates that using white pomegranate extract gel may lighten the color of teeth. Muljadi, Meizarini, and Soekartono (2013) reached the same conclusion: that the application of white pomegranate led to a lighter color shift. Due to the ellagic acid in the white pomegranate extract, a powerful oxidizing agent, the yellowing of the teeth lightens. 2 molecules of ellagic acid release 12 H<sup>+</sup> radicals and 4 OH<sup>-</sup> radicals; this is the method by which ellagic acid whitens teeth. The emission of H<sup>+</sup> radicals will precede that of OH<sup>-</sup> radicals. As a result, the electronegative difference between O and H<sup>+</sup> in the OH group is more significant than between CO<sup>-</sup> and OH<sup>-</sup> in the COOH group, causing the OH<sup>-</sup> group to break off more efficiently and generate H<sup>+</sup> radicals. The generated H<sup>+</sup> radicals subsequently attach to three tertiary C molecules in the tooth enamel that has become stained. This connection is formed because the three tertiary C molecules have less energy than other C atoms (primary C and secondary C), allowing them to attach to free radicals (H<sup>+</sup> atoms) more easily. This link results in the creation of enamel organic molecules with an unsaturated structure due to perturbations in electron conjugation and variations in energy absorption. After the H<sup>+</sup> radical is produced, ellagic acid releases four OH<sup>-</sup> radicals that might damage the enamel's unsaturated structure, causing it to become saturated and lighter in color (9).

Variations in the progression of tooth discoloration are correlated with tooth enamel thickness (the mean initial absorbance value varies). Different patients' teeth were utilized as study samples, resulting in variances in enamel layers (11)

## Conclusion

White pomegranate extract gel can be used as an alternative bleaching agent to whiten the teeth's surface.

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