

## Potency of Banana (*Musa Paradisiaca* var. *Raja*) Peel Extract as Color Changes Agent of Human Teeth (In-Vitro)

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**Abstract:** The purpose of this study is to investigate the effect of 100% banana (*Musa Paradisiaca* var. *Raja*) peel extract on color changes of human permanent teeth. This was an experimental laboratories study with pre and post-test design. Samples were human teeth that have been discolored with coffee for 14 days and separated into three groups (n=10). Samples soaked in 100% banana (*Musa Paradisiaca* var. *Raja*) peel extract for 1, 2 and 3 hours. The extract was made by ethanol maceration extraction method. The shade of tooth were analyzed visually using classical shade guide (VITAPAN Classical, Zahnfabrik, Germany) and conduct on after discoloration (baseline) and after treatment. Data were collected from the shade score (lightest to darkest). Then, to compare before and after treatment in all groups, data analyzed using paired t- test, and One-way ANOVA test to compare color changes between groups. It showed significant differences between before and after treatment in all groups ( $p \leq 0.05$ ). Meanwhile, there is no significant differences between groups ( $p \geq 0.05$ ). It was concluded that 100% banana peel extract had effect on tooth color changes and produced lighter teeth shade. However, soaking time had no effect.

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### I. Introduction

One of the esthetic challenge for dental clinician is tooth color and the present of staining on tooth affected patient's psychosocial. Tooth color is one important factor to produce attractive smile in raise someone confidence. Tooth staining or discoloration can occur due to extrinsic factors, such as dietary intake like coffee, tea, and wine; or intrinsic factors, such as systemic disease, metabolic disorders, and genetic. Tooth discoloration is not only considered as an essential requirement of beauty appearance as it can be a physical disability that affects the poor person's self-image, self-confidence, attraction and also influences in one's job.<sup>1,2</sup>

In dentistry, there are several methods to enhance the esthetics in related with tooth color, like veneer, crown, or dental bleaching. Dental bleaching is a non-invasive dental treatment to lighter/brighter tooth color using chemical bleaching agents like hydrogen peroxide, carbamide peroxide, or others agent in different concentration and application time with or without light activation. However, it was reported that chemical bleaching agents can altered enamel and affected its properties.<sup>2,3</sup> Clinician have to apprise in using chemical bleaching agents due to its safety issued and its cost. Therefore, several study were carried out to find other safer and cheaper alternative materials, such as natural ingredients as bleaching agent. Previous studies reported that fruits like tomato<sup>4</sup>, strawberry<sup>5</sup>, star fruit<sup>6</sup>, and natural ingredients such as honey<sup>7</sup> can lighten the tooth.

Bananas (*Musa paradisiaca*) leading on the first place of fruits production in Indonesia, that on 2017 the production reached 7,162,680 tons. Utilization of bananas, among others, as fruit, vegetables, traditional wound healing, and as raw materials for banana product industry, such as chips, smoked banana, and banana flour. Banana (*Musa Paradisiaca* var. *Raja*) have sweet taste and strong aroma. This banana usually consume as ripe fruit, a raw material for processed products, as well as fresh fruit, this banana has a high economic value. Banana peels form about 18-33% of all fruit and waste products, so it can be used.<sup>8,9,10</sup> Moreover, Banana peel contains several components including mineral and phytochemical components. The Mineral component consists of potassium, calcium, sodium, manganese, and iron, while the phytochemical component consists of alkaloids, flavonoids, phenols, tannins and saponins.<sup>10,11</sup> Previous studies have been conducted on natural resources contained saponin for teeth whitening, such as *rosella* (*Hibiscus sabdariffa*)<sup>12</sup>, and *belimbingwuluh* (*Averrhoa bilimbi* L)<sup>6</sup>. Banana peel is also effective as a cationic biosorbent which can absorb heavy metals contained and reported that banana skin biomass succeeded in removing 92.52% of metal ions for lead, 79.55% for copper, 63.23% for zinc, and 68.10% for nickel.<sup>13</sup> Extrinsic discoloration can be caused by the use of mouthwashes containing metal salts or cationic antiseptics and occupational exposure to metal salts.<sup>2</sup>

## II. Material And Methods

This study has been approved by Health Research Ethical Committee Medical Faculty of North Sumatera University H. Adam Malik General Hospital.

**Study Design:** Experimental Laboratory

**Teeth preparation:** The extracted human permanent teeth were collected, cleaned, and placed in Saline solution until used. Teeth with restoration, carious lesion, cracks and fractures were excluded. Later, the teeth were prepared for staining procedure. We isolated the teeth's root with transparent nail polish to avoid penetration of staining solution.

**Discoloration procedure:** A coffee solution was prepared by mixed 100g of coffee in 200mL boiling (100°C) water. Then, the teeth were soaking in coffee solution for 14 days. The coffee solution were changed every day with the fresh one. The procedure was conducted in room temperature. The shade scores after discoloration were the baseline data.

**Banana's peel extract:** The extract was made by ethanol maceration extraction method in Traditional Laboratory Pharmacy Faculty North Sumatera University. Total 5kg fresh banana's peel (*Musa Paradisiaca* var. *Raja*) were chopped and juiced in 2L ethanol (70%). Then, the juices were filtered and the filtrate was evaporated using vacuum evaporator and heated in water bath (65°C) until 100% extracted were achieved. Then, the PH of the extract were measured and the result was 6.

**Treatment procedure:** After staining, the teeth were divided into three groups (n= 10) which are 1h, 2h, and 3h according to soaking time in banana's peel extract for 1, 2, and 3 hours respectively.

**Color/shade examination:** The teeth were evaluated visually by three examiner using VITAPAN® Classical Shade Guide. The shade were observed over the buccal surface of tooth on day light. Than the shade values were scored according to: 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.<sup>14</sup> The shade were recorded after discoloration (baseline) and after treatment. Before further task, scored value from three examiner were statistically analyzed for the significances, and the data will be approved if there is no significant differences between the scores.

**Statistical analysis:** Paired *t*-test ( $p \leq 0.05$ ) was used to evaluate the significance of differences between mean values of color before and after treatment. Furthermore, One way ANOVA test ( $p \leq 0.05$ ) was used to determine the difference between color changes of all groups.

## III. Result

Total 30 permanent teeth as sample were evaluated the color on after coffee discoloration and after banana peel extract treatment using VITAPAN® Classical Shade Guide by three examiner. The result as shown on table 1 display the mean and standard deviation shade score of baseline were 10.30 (3.89), 11.20 (2.90), and 12.30 (2.26) for group 1h, 2h, and 3h respectively. For the after treatment scores were 3.70(2.45) for group 1h, 2.60(2.55) for group 2 h, and 4.50(3.17) for group 3h.

**Table 1.** Mean and standard deviation value after coffee staining, and after soaking in banana peel extract of all groups (1, 2, and 3 hours).

Group	Mean (SD) Shade Score		Paired t-test	Color changes	One way ANOVA
	baseline	After Treatment	p-value		p-value
1 h	10.30 (3.89)	3.70 (2.45)	0.005*	6.60	0.381
2 h	11.20 (2.90)	2.60 (2.55)	0.005*	8.60	
3 h	12.30 (2.26)	4.50 (3.17)	0.005*	7.80	

\*Significant differences ( $p < 0.05$ )

Meanwhile, statistical analysis by paired *t*-test present a significant differences ( $p < 0.005$ ) between baseline and after treatment shade score, but One way ANOVA test showed no significant differences ( $p > 0.05$ ) on color changes among all groups.

## IV. Discussion

This study was conducted to evaluate the ability of 100% banana peel extract on lighter the teeth shade color. The teeth were pre-treatment by soaking in coffee for 14 days to get stain effect. Diet habit like drink tea, coffee, cola, wine and eat colored food can change the color of tooth enamel to yellow to brown.<sup>2,15</sup> It was reported that coffee was found to be the most powerful chromotogen in influencing tooth color compared to tea

and cola. Potential stains on teeth are also greater because of coffee when compared to tobacco.<sup>16</sup> Coffee is rich in bioactive substances, such as nicotinic acid, trigonelline, quinolinic acid, tannic acid, pyrogallollic acid and caffeine. Tanin or also called tannic acid is a dye that is responsible for brownish discoloration that occurs in the teeth. Various kinds of acids contained in coffee also make the pH of coffee drinks to be low or acidic. Acidic conditions will soften the enamel, making it more susceptible to dyes infiltration.<sup>17</sup>

The tooth color changes were observed subjectively based on the Munsell's system of colors and hues using VITAPAN® Classical Shade Guide. Hue is quality of color that differentiates different color from each other. Shade guide is very popular and widely used method by most of the dentists all over the world. This technic is quick, simple and successfully used in many researches and produce clinically relevant results.<sup>18</sup> This research results clearly shows that there are changes in teeth color before and after immersion in 100% banana extract.

The result shows that the tooth color become lighter, indicated by the low shade score, after soaking in 100% banana peel extract for 1,2, and 3 hours. Banana peel contain saponin and has cationic biosorbent ability that can lighten the tooth color. Saponins in banana peels are bioactive compounds that can bind the chromogen so that they can lighter teeth.<sup>11</sup> Saponins are glucosides with foaming characteristics, namely foam that can act as a cleaning agent. Moreover, saponins consist of polycyclic glycosides which are bound to one or more sugar chains. The ability of foaming of saponins is caused by a combination of hydrophobic saponins (fat soluble) and part of the hydrophilic sugar chain (soluble in water), which is a combination of polar and non-polar groups.<sup>19</sup>

In this study, the pH of 100% banana peel extract was 6. This shows that this pH does not cause erosion of the teeth. It was reported that several factors such as pH, concentration, exposure time, and frequency of exposure can contribute to enamel erosion and cause whitening effects on teeth.<sup>20</sup> Meanwhile, exposure time in this study is 1, 2, and 3 hours, and it was have no effect on color changes. Although for all groups the after treatment shade found to become lighter (decreased on shade score) than before treatment. This study has founded the potency of banana (*Musa Paradisiaca var. Raja*) as tooth bleaching agents. Moreover, the mechanisms of banana peel extract as bleaching agent was not yet clear due to the limitation of this study and need further investigation.

## V. Conclusion

It can be conclude that 100% banana peel extract (*Musa Paradisiaca var. Raja*) can lighten the tooth color and soaking time has no effect on the tooth color changes. Further research is needed to evaluate the effectiveness of banana peels extract as teeth bleaching.

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