

# Preference Level for Robusta Green Coffee Bean Extract Toothpaste among Students at the University of Jember, Indonesia

Desi Sandra Sari<sup>1</sup>, Shabrina Tuhva Chaliqi<sup>2</sup>, Yuliana Mahdiyah Da'at Arina<sup>1</sup>

<sup>1</sup>Periodontology Department, <sup>2</sup>Faculty of Dentistry, University of Jember, Jawa Timur, Indonesia

## ABSTRACT

**Background:** Robusta green coffee bean extract toothpaste was an alternative product for preventing caries and periodontal disease. As a product, a hedonic test to determine consumer acceptance and satisfaction was needed. This research assessed the preference level for robusta green coffee bean extract toothpaste among students at the University of Jember, Indonesia.

**Methods:** This is an experimental and analytical observational study. The robusta green coffee bean was extracted using the maceration method with 96% ethanol. The toothpaste was made by mixing placebo paste ingredients with robusta green coffee bean extract at concentrations of 0.0625%, 0.125%, 0.25%, and 0.5%. The hedonic test included color, aroma, and texture parameters with a Likert scale and was carried out in the period August-November 2023 by 30 students from the Faculty of Dentistry, University of Jember, who were healthy, without allergies, and did not smoke. SPSS v26 was used and the mean score was calculated as the level of preference. Statistical test with Kruskal Wallis followed by Mann Whitney with  $p$ -value < 0.05 significant.

**Results:** The cut-off value of the mean score was 3-5 for the highest level of preference with  $4.00 \pm 1.174$  for color parameters and  $3.73 \pm 0.907$  for texture parameters, shown by 0.5% concentration of robusta green coffee bean extract toothpaste, while for aroma parameters was  $4.13 \pm 0.681$ , shown by 0.25% concentration of toothpaste. Overall, the highest level of all parameters preference was  $3.93 \pm 0.691$  shown by 0.5% concentration of toothpaste but there was no significant difference with 0.25% concentration ( $p > 0.05$ ).

**Conclusion:** Robusta green coffee bean extract toothpaste with concentrations of 0.25% and 0.5% were preferred by consumers.

**Keywords:** Coffea, Consumer Preference, Toothpastes.

### Corresponding author:

**Dr. Yuliana Mahdiyah Da'at Arina**

Periodontology Department,

Faculty of Dentistry,

University of Jember,

Jawa Timur, Indonesia

Email: yuliana.mda@unej.ac.id

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## INTRODUCTION

Periodontal disease is the inflammation of the tissue that surrounds the teeth which usually begins as gingival inflammation and damages other tooth-supporting tissues as well<sup>1,2</sup>. In Indonesia, 73.1-75% of the population has periodontal disease, according to the National Basic Health Research report in 2018, while 13.7-14.1% have gingivitis and experience bleeding gums<sup>3</sup>.

Dental plaque, a bacterium comprising biofilm, is a common etiologic factor for gingivitis<sup>4</sup>. Its accumulation can be prevented mechanically i.e., by brushing teeth properly using toothpaste, a paste, or gel dentifrice used with a toothbrush, which has become a necessity to maintain good oral health<sup>5</sup>.

In general, toothpaste contains abrasive ingredients, therapeutic ingredients, water, humectants, detergents, sweeteners, and others<sup>6</sup>. Antibacterials are one of the benefits that can be obtained for dental and oral health from natural ingredients<sup>7</sup>. One of the natural ingredients added to toothpaste by exploiting the potential of plantations in Jember Regency is robusta green coffee beans<sup>8</sup>. Indonesia is an agricultural country with a variety of coffee beans that are of the best quality in Southeast Asia<sup>9</sup>.

We are currently developing herbal toothpaste using robusta green coffee bean extract. Our previous research proved that robusta green coffee bean extract toothpaste can reduce the production of dental plaque and can inhibit the growth of periodontal bacteria, namely *Porphyromonas gingivalis* and *A. actinomycetemcomitans*<sup>10,11</sup>. The biocompatibility of robusta green coffee bean extract was obtained at concentrations of 0.0625%, 0.125%, 0.25%, and 0.5%, which was safe to use on dental and oral tissue<sup>12</sup>.

The purpose of this research is to determine the level of preference for robusta green coffee bean extract toothpaste so that it can determine consumer acceptance of products that will be an alternative for preventing dental and oral diseases.

## METHODS

This is an experimental study of making robusta green coffee bean extract toothpaste and an analytical observational study to assess the preference level for the toothpaste. The first stage was making robusta green coffee bean extract, which was obtained from the renting plantation, Jenggawah Jember, East Java, using the maceration method. Robusta green coffee beans weighing 1 kg were washed, dried, then ground and sifted using a 40 mesh sieve into fine powder. The

finely ground robusta green coffee beans were then macerated using a 96% ethanol solution and then stirred every day for 5 days. The ethanol in the filtrate was evaporated using a rotatory evaporator at a temperature of 40°C and then thickened using a water bath at a temperature of 40°C until a thick extract of 100% concentration was obtained.

Toothpaste was made by adding all the placebo ingredients, namely magnesium carbonate, calcium carbonate, glycerin, propylene glycol, TEA (Triethanolamine), and oleum mentha piperita into a mortar and then mixing it using a pestle until it forms a paste (control group). The next step was adding coffee bean extract with concentrations of 0.0625%, 0.125%, 0.25%, and 0.5%, stirring until a homogeneous mixture was achieved, then it was placed in a closed container (treatment group).

Then a preference level test i.e., the hedonic test, was carried out, aimed to determine the panelists' responses by providing an assessment of their preference level<sup>13</sup>. The panelists used in this study were 30 students from the Faculty of Dentistry, University of Jember, who had fulfilled the inclusion criteria. Inclusion requirements included panelists who are willing to take part in the hedonic test, do not have any allergy to the hedonic test samples, are in good health, not being full or hungry before the hedonic test, and do not smoke. Exclusion requirements included panelists who did not fulfill the inclusion criteria.

The panelists assessed the level of preference for Robusta green coffee bean extract toothpaste regarding color, aroma, and texture parameters on the Likert Scale with the following categories; 1 dislike it very much, 2 dislike it, 3 neutral, 4 they like it, and 5 like it very much<sup>14-16</sup>. The preference level for each parameter was then obtained by calculating the average score of all the panelists. The pilot test results show that the instrument measurement results are valid with Cronbach's Alpha coefficient of the color 0.70, the aroma 0.76, and the texture 0.75. The assessment of the level of preference is obtained by calculating the average score obtained by each treatment group on the three parameters<sup>17</sup>. The hedonic value or overall preference value of Robusta green coffee bean extract toothpaste was determined by the mean score of color, aroma, and texture parameters. The data showed as Mean ± SD.

SPSS version 26 was used and the data were tested for normality with the Shapiro-Wilk test which showed that the data were not normally distributed ( $p < 0.05$ ) and for homogeneity was tested with Levene's test which showed that the data were not homogeneous ( $p < 0.05$ ). To determine the difference between groups, the Kruskal-Wallis's test was carried out followed by the Mann-Whitney test

with a p-value < 0.05 to be considered significant.

**RESULTS**

The result of this study found that robusta green coffee bean extract toothpaste showed a different color. Toothpaste without robusta green coffee

bean extract (control groups) is white, toothpaste with robusta green coffee bean extract with a concentration of 0.0625% which is yellowish white, 0.125% which is light yellow, 0.25% which is greenish yellow, and 0.5% which is colored light green (Figure 1).

**Figure 1: The different colors of toothpaste (a) toothpaste without robusta green coffee bean extract; (b) robusta**



**green coffee bean extract toothpaste 0.0625%; (c) 0.125% robusta green coffee bean extract toothpaste; (d) 0.25% robusta green coffee bean extract toothpaste; (e) Robusta green coffee bean extract toothpaste 0.5%.**

The result showed that for the color parameter, the highest preference value was 4.00 (±1.174), obtained by Robusta green coffee bean extract toothpaste 0.5% and the lowest preference value was 2.97 (±0.809) obtained by the Robusta green coffee bean extract toothpaste 0.125%. For the aroma parameter, the highest preference value was 4.13 (±0.681) obtained for the Robusta green coffee bean extract toothpaste of 0.25% and the lowest favorability value was 3.67 (±0.922) obtained for the Robusta green coffee bean extract toothpaste 0.0625%. For the texture parameter, the

highest preference value was 3.73 (±0.907) obtained for robusta green coffee bean extract toothpaste 0.5%, and the lowest preference value was obtained for the toothpaste sample without robusta green coffee bean extract 1.87 (±0.937). For all parameters, the highest preference value (hedonic value) was 3.93 (±0.691) obtained by robusta green coffee bean extract toothpaste 0.5%, and the lowest preference value was obtained by the toothpaste without robusta green coffee bean extract (control groups) (Table 1).

**Table 1: The level of preference for Robusta green coffee bean extract toothpaste.**

Toothpaste Concentrations	Color ( $\bar{x}$ ) ± SD)	Aroma ( $\bar{x}$ ) ± SD)	Texture ( $\bar{x}$ ) ± SD)
Toothpaste without robusta green coffee bean extract (Control)	3.13± 1.332	3.70± 0.952	1.87± 0.937
Robusta green coffee bean extract toothpaste 0.0625%	3.30± 0.988	3.67± 0.922	3.50± 0.900
Robusta green coffee bean extract toothpaste 0.125%	2.97± 0.809	3.67± 0.994	3.47± 0.937
Robusta green coffee bean extract toothpaste 0.25%	3.57± 1.006	4.13± 0.681	3.63± 0.669
Robusta green coffee bean extract toothpaste 0.5%	4.00± 1.174	4.07± 0.944	3.73± 0.907
p-value	0.002*	0.066	0.001*

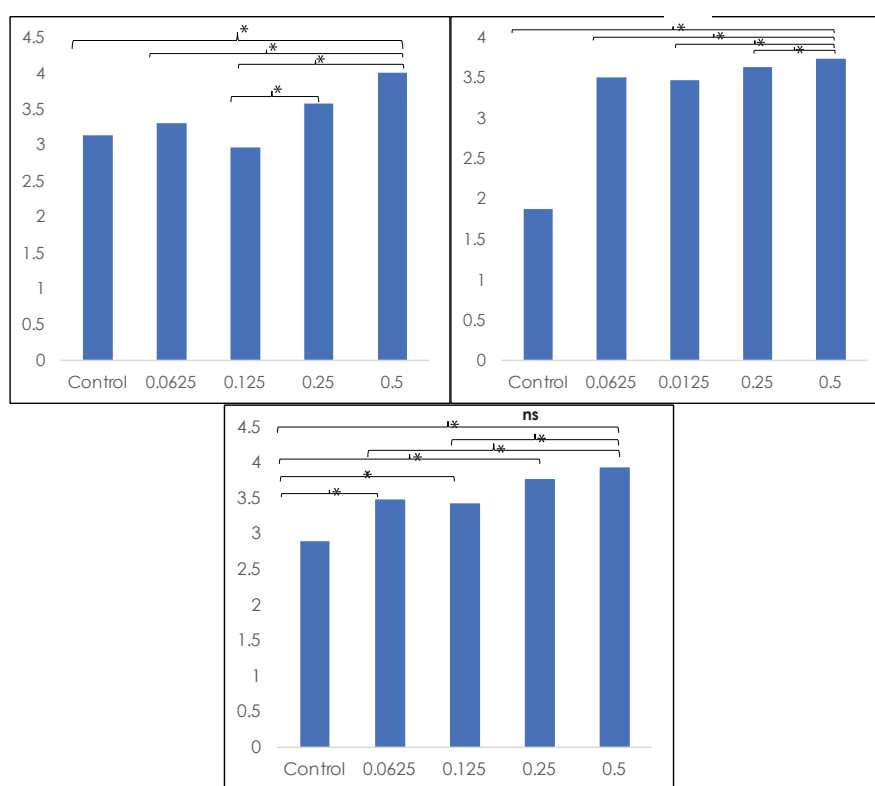
( $\bar{x}$ ) ± SD) = Mean ± Std deviation, Scale 1: dislike very much; 2: dislike; 3: neutral; 4: like; 5: like very much

The results of the Kruskal-Wallis test showed that there was a significant difference in the level of preference for color parameters between groups (p= 0.002). The Mann-Whitney test showed there was a significant difference between the level of preference for the color parameter for robusta green coffee bean extract toothpaste 0.5%

compared to the other groups (control p=0.010, 0.0625% p=0.007, 0.125% p=0.000) except the 0.25% groups (p=0.058). Then a significant difference was also found between the Robusta green coffee bean extract toothpaste 0.25% and the 0.125% groups (p= 0.014).

For aroma parameters, the results of the Kruskal Wallis test showed that there was no significant difference in the level of preference of aroma parameters between groups ( $p=0.066$ ). Whereas the results of the Kruskal-Wallis test on texture parameters showed that there was a significant difference in the level of preference between groups ( $p=0.000$ ). The Mann-Whitney test showed there was a significant difference between the level of preference for texture parameters for all concentrations of robusta green coffee bean extract toothpaste compared to control groups ( $p=0.000$ ). However, there was no significant difference between robusta green coffee bean extract toothpaste groups ( $p>0.05$ ). Based on the Kruskal Wallis test, the hedonic value or overall preference value of Robusta green coffee bean

extract toothpaste showed a significant difference ( $p=0.000$ ). The Mann-Whitney test showed there was a significant difference ( $p<0.05$ ) for all concentrations of robusta green coffee bean extract toothpaste compared to control groups. The hedonic values of Robusta green coffee bean extract toothpaste in 0.5% groups showed a significant difference compared to 0.0625% ( $p=0.019$ ) and 0.125% groups ( $p=0.01$ ). In the color parameter, there was a significant difference between the level of preference for 0.5% robusta green coffee bean extract toothpaste compared to the other groups except for the 0.25% group. Then a significant difference was also found between the 0.25% Robusta green coffee bean extract toothpaste and the 0.125% group ( $P < 0.05$ ) (Figure 2).



**Figure 2: The level of preference for Robusta Green Coffee Bean Extract Toothpaste based on the a) color, b) texture, and c) Hedonicity of all the parameters. \*significant at 0.05, <sup>ns</sup> non significant. Kruskal Wallis test was applied followed by the Mann Whitney U test.**

## DISCUSSION

Hedonic tests can be used to assess new products by providing a level of consumer acceptance<sup>18</sup>. The hedonic test in this study aimed to determine the level of preference for robusta green coffee bean extract toothpaste based on color, aroma, and texture parameters. Color is the first parameter that makes an impression on the panelists and can be immediately assessed by the panelists. Attractive colors will increase the panelist's tastes so that they are interested in tasting a product<sup>6</sup>. In this study, the

color of toothpaste was affected by the addition of different concentrations of robusta green coffee bean extract in each group, from white in the control groups gradually to light yellow in the robusta green coffee bean extract toothpaste 0.125% groups and light green in 0.5% groups. This color change seems to be a special attraction for the panelists so the preference level of the robusta green coffee bean extract toothpaste 0.5% showed the highest value compared to other groups. This study was in line with research which states that the

volume of *Citrus medica* orange juice added to toothpaste can provide a color that is preferred by panelists<sup>17</sup>.

Aroma is a parameter in an organoleptic test that uses the sense of smell<sup>6</sup>. Aroma is a smell produced by chemical stimulation and smelled by the olfactory nerves in the nasal cavity. The specific aroma of a product can make the product acceptable. Coffee has a fairly distinctive aroma, however, the results of this study found that there was no significant difference in the level of preference of aroma parameters between groups. In this study, green coffee beans were used, where the coffee aroma emitted was not as strong as processed coffee beans. Two types of processed coffee are widely available on the market, ground coffee and instant coffee. Ground coffee has a more pungent coffee aroma, meanwhile, instant coffee has a fragrant aroma<sup>19</sup>. Even though there has been an increase in the preference value for coffee bean extract toothpaste, the aroma of the coffee bean extract may not be able to beat the distinctive aroma originating from the *oleum mentha piperithae* ingredient of the placebo toothpaste.

Texture is a testing parameter that uses the sense of touch<sup>20</sup>. Texture influences the image of a product, including toothpaste. Testing the texture of toothpaste was carried out by taking a small sample and then feeling it with your finger<sup>21,22</sup>. The level of preference for Robusta green coffee bean extract toothpaste in texture parameters showed a significant difference between the control group and all treatment groups ( $p < 0.05$ ). The toothpaste group without robusta green coffee bean extract has a rough texture and looks like lumps. As the Robusta green coffee extract was added, the texture might become softer. The robusta green coffee bean extract toothpaste 0.5% may have a soft texture so showed the highest level of preference. This result could be because the administration of the extract affects the texture of the toothpaste, the more concentration is given, the softer the texture of the toothpaste will be, so the panelists will like it. The texture of the toothpaste may be one of the most important things to pay attention to because the texture of the toothpaste will be felt by the tongue when brushing the teeth<sup>23,24</sup>.

Based on all parameters, including color, aroma, and texture, the panelist's level of preference was proportional to the addition of the concentration of Robusta green coffee bean extract. The highest preference score for hedonic tests was obtained by Robusta green coffee bean extract toothpaste at 0.25% and 0.5% with a neutral category, while the lowest preference score was obtained by toothpaste without Robusta green coffee bean extract

with a dislike category. This showed that the addition of Robusta green coffee bean extract influences the level of panelists' preference for Robusta green coffee bean extract toothpaste on color, aroma, and texture parameters.

## CONCLUSION

The hedonic assessment based on the level of preference for Robusta green coffee bean extract toothpaste on color, aroma, and texture parameters concluded that Robusta green coffee bean extract toothpaste is preferred by consumers. This study result provides information from descriptions of product sensory characteristics that can be a reference in developing ideal toothpaste products according to consumers.

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## CONFLICT OF INTERES

The authors declared no conflict of interest.

## ETHICAL APPROVAL

This research has received approval from The Ethical Committee of Medical Research Faculty of Dentistry University of Jember. (No.2262/UN25.8/KEP-K/DL/2023)

## AUTHORS CONTRIBUTION

DSS: Conceptualization, Manuscript Writing. STC: Investigation, Analysis Data, Draft Writing. YMDA: Conceptualization, Analysis Data, Manuscript Writing.

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