EFFECT OF THE ADDITION OF BLACK TEA, LEMONGRASS, LIME, AND LEMON ON THE SENSORY CHARACTERISTICS OF KECOMBRANG FLOWER TEA (*Etlingera elatior*)

Nabilla Mutia Rizki, Rifda Naufalin*, Poppy Arsil, Popi Nurhopipah
Department of Agricultural Technology, Faculty of Agriculture, Universitas Jenderal Soedirman, Purwokerto, Indonesia

*Email: rifda.naufalin@unsoed.ac.id

Abstract. Tea is a popular beverage consumed after water, largely due to the health benefits associated with it. The kecombrang plant (*Etlingera elatior*) is known to contain biochemical compounds such as alkaloids, saponins, tannins, phenolics, flavonoids, triterpenoids, steroids, vitamins, minerals, and glycosides. Kecombrang flower tea is an innovative product aimed at optimizing the use of kecombrang flowers. This tea has a red color, along with a distinctive taste and aroma, which may require the addition of other ingredients like black tea, lemongrass, lime, and lemon to enhance its organoleptic quality. The purpose of this study was to determine the effect of adding black tea, lemongrass, lime, and lemon on the sensory characteristics of kecombrang flower tea through a hedonic test. A completely randomized design (CRD) was employed in this study, with the factor under investigation being the addition of variants such as black tea, lemongrass, lime, and lemon. The tested variables included a hedonic test to assess the level of panelist preference for color, taste, aroma, and overall attributes. The results indicated that the addition of these variants significantly affected consumer preference. The sample of kecombrang flower tea with the addition of black tea was the most preferred by the panelists.

Keywords: tea, hedonic, sensory, kecombrang flower

A. Introduction

Tea is a popular beverage consumed by Indonesians by brewing and drinking with the addition of sugar. The term tea can be used for drinks made from fruit, spices or other plant parts such as skin, flowers, leaves and roots that are brewed [1]. The tea brewing process is related to the extraction process of several compounds contained in tea, especially polyphenolic compounds [2]. As the most consumed beverage after water, the tradition of drinking tea in Indonesia is a hereditary tradition that was originally owned by the nobility. This tradition then spread and became a habit of the wider community. Health benefits, freshness, flavor and distinctive aroma are factors in people's interest in consuming tea.

Kecombrang (*Eltingera elatior*) is one of the plants from the Zingiberaceae tribe. Kecombrang is generally used as a flavor giver in dishes and medicines that are efficacious for eliminating body odor and bad breath [3]. Besides being used as a complement to food, kecombrang flowers are also known to be used as raw material for tea products. Kecombrang flower tea produces a red color and distinctive aroma that comes from the anthocyanin content and volatile compounds in the form of essential oils in kecombrang flowers [4]. In a study conducted by [5], it was found that the flower and stem sections of the torch ginger plant contain bioactive chemicals that exhibit greater antioxidant activity compared to the leaf and rhizome components. The bioactive constituents found in the substance consist of alkaloids, flavonoids,

polyphenols, triterpenoids, steroids, saponins, and essential oils. Many mature fruits contain flavonoids, which include anti-inflammatory, antibacterial, antioxidant, anti-allergenic, and anticancer characteristics. The capacity of a chemical to release H+ ions from its hydroxyl groups as a reducing agent can lead to antioxidant activity [6].

B. Methods

The materials used in this study include kecombrang flower simplisia, black tea powder, lemon powder, lime powder, sugar and water. The tools used in this research are serving chambers, hedonic test sheets, puplen, mineral water, cabinet dryer, knife, cutting board, baking sheet, basin, digital scale, spoon, and plastic cup. The method used in this research is experimental method. The experimental design carried out in this study was a completely randomized design (CRD) with one factor without repetition. The factor studied was the addition of flavor variations in the form of black tea, lemongrass, lime and lemon.

In order to obtain a functional drink with organoleptic quality that is favored by consumers, certain ingredients are added to improve product performance in serving tea as a drink. It is known that kecombrang flowers have a taste and aroma that is less familiar to some people. Therefore, the addition of lemongrass, lime and lemon, which contain aromatic compounds and various other compounds, aims to improve the acceptability of the aroma attributes, freshness and flavor variations of the chamomile flower tea product. Sample preparation Kecombrang flowers, lemongrass, citrus fruits, lemon, black tea powder (Sariwangi brand, 25 tea bags weighing 1.85 grams each), and beetroot powder (Cairo Food brand, 100 grams) were bought from Purwokerto, Central Java, Indonesia. Kecombrang flowers were thoroughly washed under a continuous flow of water, and any damaged blossoms were removed. Kecombrang flower was pulverized to a length of 2 mm using a grinder. The lemongrass stem were cleaned and then manually cut into segments that were about 1 cm long. Afterwards, they were thinly sliced to a thickness of around 3 mm using a knife. Kecombrang flower, lemon, and orange were reduced in size and then placed on a baking sheet. They were dried in a cabinet drier at a temperature of 60°C for a duration of five hours (Naufalin et al., 2019). Kecombrang flower tea was formulated using the ingredients indicated in Table 1.

Table 1. Formulation of five products of torch ginger flower tea

Ingredients	Samples				
	K1	K2	K3	K4	K5
Torch ginger flowers (g)	0,9	0,73	0,58	0,58	0,58
Black tea (g)	-	0,18	0,13	0,13	0,13
Beetroot powder (g)	0,1	0,09	0,07	0,07	0,07
Lemongrass stem (g)	-	-	0,20	-	-
Oranges (g)	-	-	-	0,20	-
Lemon (g)	-	-	-	-	0,20

The variable measured in this study is to observe the characteristics of hedonic properties of kecombrang tea given the addition of black tea, lemongrass, lime and lemon using hedonic test. The panelists were students from the department, university and staff. Panelists evaluated 5 sample formulations of kecombrang tea where each sample was given a 3-digit random number and the order of the samples was randomized on the test sheet. Each panelist was given 5 samples of chamomile tea with different formulations as much as 30 ml. Panelists were asked to rinse their mouths with water for each sample test. The test sheet directed the panelists to evaluate the attributes of color, taste, aroma and overall liking using a 5-point hedonic scale (1= Strongly dislike, 2= Dislike, 3 = Slightly Like, 4 = Like, 5 = Really Like). The total panelists

used were 150 people. The panelist hedonic test data obtained were analyzed using the Friedman test and then continued with the LSD further test.

C. Results And Discussion

A product is basically composed of a collection of attributes that can be used as an assessment of consumer preferences in a product. In this study, the attributes used in the liking level test are color, taste, aroma and overall attributes. The results of the hedonic test of the five formulations of kecombrang flower tea assessed from the level of liking of color, taste, aroma and overall attributes showed that most consumer panelists liked kecombrang flower tea with the addition of black tea. This is thought to be due to the distinctive flavor and aroma of chamomile flowers that are less preferred by consumer panelists. This is reinforced by the low level of panelists' liking for the original sample or the sample of chamomile flower tea that is not given the addition of variants.

1. Color

The color produced by tea is the result of steeping which dissolves the compounds in the material so that there is an extraction process due to the influence of temperature and brewing time. The color of steeping tea shows a physical appearance that is easily recognized without having to interact with the product first. It is known that the Asymptotic Significance value is 0.000 <0.05. Then H_0 is rejected and H_a is accepted, in other words, there is a difference in the average level of panelists' liking for color attributes in the 5 kecombrang tea samples. So it can be concluded that the color attribute in kecombrang tea affects the level of panelist liking. To find out if there is a significant difference in treatment that affects the color of kecombrang flower tea, the LSD test is conducted which can be seen in Table 2.

Table 2. Average value of kecombrang flower tea on color attributes

Sample	Average Value	Description
K1	$2{,}48^a$	Dislike - slightly like
K2	$4{,}20^c$	Like – Really Like
K3	$3{,}95^c$	Slightly like – Like
K4	$3{,}50^b$	Slightly like – Like
K5	$3{,}63^b$	Slightly like – Like

Notes: The same notation means not significantly different in the LSD test at the α (0.05) level.

Based on Table 2, it can be seen that the level of panelist acceptance of the color attributes of kecombrang flower tea ranges from 2.48 to 4.20 or at the level of dislike to like. Treatment K2 has the highest score with a value of 4.20. While the K1 treatment with a value of 2.48 occupies the lowest score among other samples. There was no significant difference between sample K4 and sample K5. It is known that sample K5 is a sample of kecombrang tea which is given the addition of lemon simplisia. The addition of lemon simplisia affects the color produced by kecombrang flower tea where lemon peel simplisia contributes a yellowish color. Research by [7] states that the addition of lemon peel increases the brightness of dragon fruit peel tea products. The increase in brightness is in line with the higher concentration of lemon peel added. The yellowish color is known to come from the presence of carotene pigments in lemon peel.

2. Taste

The taste that arises in food comes from chemical components contained in food ingredients which will then provide stimulation to the senses in the form of the tongue to determine the taste of sour, sweet, bitter and salty and leave an impression after swallowing the product [8]. In addition to chemical components, flavor is also influenced by other factors such as temperature, concentration, and interaction with other flavor components [1]. Flavor is an

attribute that is considered in making purchasing decisions for tea products by consumers and potential consumers. The flavor attribute is an indicator of liking or disliking a product so that the purpose of consumers buying tea is to consume and enjoy the taste.

It is known that the Asymptotic Significance value is 0.000 <0.05. Then H_0 is rejected and H_a is accepted, in other words, there is a difference in the average level of panelists' liking for the taste attributes of the 5 kecombrang tea samples. So it can be concluded that the flavor attributes in kecombrang tea affect the level of panelist liking. To find out if there is a significant difference in treatment that affects the flavor of kecombrang flower tea, the LSD test is conducted which can be seen in Table 3.

Table 3. LSD test of kecombrang flower tea on flavor attributes

Sample	Average Value	Description
K1	$3{,}00^{a}$	Slightly like
K2	$4{,}03^{c}$	Like
K3	$3{,}62^{b}$	Slightly like – Like
K4	$3{,}09^{a}$	Slightly like
K5	$3{,}53^{b}$	Slightly like – Like

Notes: The same notation means not significantly different in the LSD test at the α (0.05) level.

In general, the level of panelists' acceptance of the taste attributes of kecombrang flower tea ranged from 3.00 to 4.03 or at the level of slightly like to like. Treatment K2 has the highest score with a value of 4.03 at the level of like. While the K1 treatment with a value of 3.00 has the lowest score but has no significant difference with the K4 sample at the level of panelist liking of the flavor attribute. Kecombrang flower tea has a distinctive flavor that is not familiar so that it is less attractive to consumers. Research by [5] stated that the sour taste that arises in steeping chamomile flower tea is caused by the presence of organic acids in chamomile. The K4 sample of kecombrang flower tea showed no significant difference from the K1 sample with a score of 3.09.

3. Aroma

Aroma is defined as an odor produced by chemical stimuli in food ingredients which are then smelled by olfactory nerves in the nasal cavity [8]. Aroma is a form of aromatic compound that is volatile so it is easily captured by the olfactory nerves [9]. The results of the hedonic test regarding the level of panelist preference for the aroma attributes of chamomile flower tea tested by 150 untrained panelists showed that panelists liked chamomile flower tea with the addition of black tea the most compared to other samples. Known Asymptotic Significance value of 0.000 <0.05. Then H_0 is rejected and H_a is accepted in other words there is a difference in the average level of panelist liking of the aroma attribute in 5 samples of kecombrang tea. It can be concluded that the aroma attribute in kecombrang tea affects the level of panelist liking. To find out if there is a significant difference in treatment that affects the aroma of kecombrang flower tea, the LSD test is conducted which can be seen in Table 4.

Table 4. LSD test of kecombrang flower tea on aroma attributes

Sample	Average Value	Keterangan
K1	$3{,}00^{a}$	Slightly like
K2	$3{,}84^{b}$	Slightly like – like
K3	$3{,}79^{b}$	Slightly like – like
K4	$3{,}83^{b}$	Slightly like – like
K5	$3{,}69^{b}$	Slightly like – like

Notes: The same notation means not significantly different in the LSD test at the α (0.05) level.

In general, the level of panelist preference for aroma attributes ranged from 3.00 to 3.84 or at the level of slightly like to like. Sample K1 is the sample with the lowest average value and is significantly different from the other four samples in the assessment of the level of liking for the aroma attributes of kecombrang flower tea. In addition to flavor attributes, aroma also plays an important role in consumer preferences in choosing tea products. The aroma component is directly related to the volatile components of a material. Kecombrang flower tea is known to have a distinctive aroma that is less preferred by consumers. The component that plays a role in the formation of aroma in kecombrang flowers is essential oil of 0.4% (v/b) which is dominated by alcohol (29.4%) and esters (22.6%) [5].

Therefore, this study added black tea, lemongrass, lime and lemon to improve the quality and quality of the product. Black tea is one type of commercial tea that is widely produced and marketed in Indonesia so that the distinctive taste and aroma of black tea is no longer a foreign thing. The addition of black tea to the formulation of kecombrang flower tea is considered to improve the sensory properties of tea aroma so that it is more easily accepted by panelists. In this study, the addition of black tea ranks the highest level of panelist preference for aroma attributes with an average value of 3.84. The distinctive aroma of tea as black tea powder is added is attributed to the aromatic compounds contained in black tea. The oxidation process of polyphenols during the fermentation process of black tea will decompose proteins that cause the aroma of black tea [10].

4. Overall

The overall attribute assessment includes color, taste and aroma incorporated in the overall attribute. The results of the hedonic test regarding the level of panelist preference for the overall attributes of chamomile flower tea tested by 150 untrained panelists showed that panelists liked chamomile flower tea with the addition of black tea the most compared to other samples. It is known that the Asymptotic Significance value is 0.000 <0.05. Then H_0 is rejected and H_a is accepted, in other words, there is a difference in the average level of panelist liking of the overall attributes of the 5 samples of kecombrang tea. It can be concluded that the overall attributes of kecombrang tea affect the level of panelist liking. To determine whether there are significant treatment differences that affect the overall attributes of kecombrang flower tea, the LSD test is conducted which can be seen in Table 5.

Table 5. LSD test of kecombrang flower tea on overall attributes

Sample	Average	Description
K1	$3{,}00^{a}$	Slightly like
K2	$4{,}20^{c}$	Like
K3	$3{,}82^{bc}$	Slightly like – like
K4	$3{,}44^{b}$	Slightly like – like
K5	$3{,}67^{bc}$	Slightly like – like

Notes: The same notation means not significantly different in the LSD test at the α (0.05) level.

Assessment of the panelists' level of liking for the overall attributes showed an average value in the range of 3.00 to 4.20 or at the level of slightly like to like. Sample K1 ranks lowest with an average level of liking of 3.00 while sample K2 is the sample with the highest average value. Based on the overall attribute assessment, it is also known that samples K3 and K5 have no significant difference. At the overall attribute, panelists assess a product from various aspects including color, taste and aroma. In this study, kecombrang tea with the addition of black tea got the highest average value of the panelists' level of liking of the overall attributes followed by the sample of kecombrang tea with the addition of lemongrass. While the original sample gets the lowest average value compared to other samples. From these data, it can be seen that overall, panelists preferred the chamomile tea that was given the addition of variants in other

words, the addition of variants in this study in the form of black tea, lemongrass, lime and lemon can improve taste, improve product performance in terms of organoleptic and increase panelist acceptance of chamomile tea products.

D. Conclusion

The addition of variants in the form of black tea, lemongrass, lime and lemon in the formulation of kecombrang flower tea affects the level of consumer preference. The sample of kecombrang tea with the addition of black tea (K2) is the sample most favored by consumers.

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