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Sensory quality of cascara brewing with ginger extract addition

Zalniati Fonna Rozali[1*], Murna Muzaifa[1], Muliana[1], Faidha Rahmi[2]

[1]*Agricultural Product Technology, Universitas Syiah Kuala, Banda Aceh, Indonesia*
[2]*Agrotechnology, Universitas Gajah Putih, Aceh Tengah, Indonesia*

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ABSTRACT

Coffee processing by-products can be used as a healthy beverage product called cascara. However, in Indonesia, consumers' preference for the taste of cascara is still unsatisfactory. This study aims to increase cascara's sensory quality with adding ginger extract. This study used a non-factorial Completely Randomized Design consisting of 4 ginger extract concentration treatments: J0 = 0%, J1 = 3%, J2 = 6% and J3 = 9%. Each treatment was repeated 3 times. The panelist acceptance was carried out for color, aroma, and taste to determine the sensory quality. Besides that, the pH value is also analyzed to determine the acidity level of the cascara brewing. The data were statistically analyzed using analysis of variance and DMRT further test at the 5% level. The results showed that adding ginger extract at various concentrations affected all panelists' acceptance of the cascara brewing drink and pH. Increasing the concentration of ginger added to increased acceptance of the color and taste of cascara brewing and the drink's pH. The highest aroma, taste, and pH values were obtained in the treatment with the highest concentration of 9% ginger. In comparison, the most favorable color was obtained in the treatment without adding ginger and adding ginger with a concentration of 9%. The results showed that adding ginger extract had a positive effect on improving the sensory quality of cascara brewing, and the addition of 9% ginger extract had the potential to develop as a functional drink.

[*] Corresponding author
Email : zalniatifonnarozali@unsyiah.ac.id
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INTRODUCTION

Coffee (*Coffea* sp.) is one of the most popular beverages in the world besides tea. Coffee is popular because of its delicious taste and is also believed to be able to provide a stimulating effect with its caffeine content (Rebollo-Hernanz et al. 2019). For countries that produce and export coffee beans, coffee commodities are very important for the country's foreign exchange. Brazil, Vietnam, Colombia, Indonesia, and India are the top five coffee-producing countries in the world. According to Statistic Indonesia, Indonesia's coffee production in 2021 reached 774.6 thousand tons (Wolff 2021).

Coffee is generally traded as green beans from several planting and processing stages. During coffee planting and processing, large quantities of by-products are produced. These products can cause environmental impacts in coffee-producing countries, so their recycling has become increasingly important. Coffee plant parts such as flowers, leaves, twigs, and wood are classified as coffee by-products because they arise during planting (Klingel et al. 2020). The other by-products produced in the processing stages can be pulp, husk, epidermis, and coffee grounds, depending on the method and stages of processing (Muzaifa et al. 2021). In general, during processing from coffee cherries (red coffee pods) to beans, about 40-45% of by-products are formed (Nabais et al. 2008; Mussatto et al. 2011; Esquivel and Jiménez 2012)

Klingel et al. (2020) have reported that, traditionally, several countries have processed coffee by-products into functional foods, such as tea, jams, sauces, and mixed ingredients in bakery products. It happened because the coffee by-products also contain a number of beneficial compounds to increase human health, such as caffeine, chlorogenic acid, phenolic compounds, tannins, and fiber. Cascara (Figure 1) is one of the by-products of coffee most often used as tea. Cascara is made from dried coffee husks (pulp and husk). This drink is considered a new drink in the United States and Indonesia, even though this drink has long been known by Yemen, Spanish, and Ethiopian people as "quishr," "cáscara," and "hashara". Cascara can be drunk without sugar because of the coffee skin's natural sweetness and fresh sour taste (Heeger et al. 2017).

Cascara contains 58%–85% of total carbohydrates, 8%–11% of protein, 3%–7% of minerals, 0.5%–3% of lipids, 1% of caffeine and 5% of tannins (Klingel et al. 2020). The Cascara Brewing contains 226 mg/l of caffeine and 283 mg/l of gallic acid equivalents, representing the total polyphenol content (Heeger et al. 2017). Other studies show that cascara infusion brewing has biological activities such as anti-inflammatory, anti-oxidative stress, anti-adipogenesis, and insulin resistance (Rebollo-Hernanz et al. 2019).

Figure 1 Dried cascara

Several studies have been carried out to produce cascara tea from the skin of Gayo Arabica coffee (Muzaifa et al. 2020; Arpi et al. 2021), but the results have not been satisfactory. Cascara drinks are produced in their original form without adding any ingredients so that the level of consumer acceptance of the taste of cascara is still normal (Limbong 2019). Efforts to increase the acceptance of cascara need to be made so that optimization of the utilization of coffee skin can be carried out.

Ginger (*Zingiber officinale*) is a spice that is quite popular and has been used as a refreshing flavor in drinks. Ginger has also been used as a traditional medicine for a long time because it contains oleoresin and other active components such as zingeron, shogaol, and gingerol, which gives ginger its spicy characteristic (Srikandi et al. 2020). The oleoresin content of ginger ranges from 3.2-9.5%, while the content of gingerol in

oleoresin is between 14-25% and shogaol between 2.8-7.0% oleoresin (Anggista et al. 2019)

Research on the addition of ginger to beverages has been widely carried out. Ginger extract is generally added to beverages with less favorable sensory values, so adding ginger extract is expected to increase the sensory value of a drink. One example is the ginger okra drink. The okra drink is less favorable from a sensory point of view, but adding ginger can increase the sensory acceptance of the okra drink. Ginger is a distinctive spicy flavor enhancer (Azni and Amelia 2019).

The addition of flavors from ginger has the potential to increase the acceptability of cascara drinks. Previous studies reported that functional drinks made using ginger extract with concentrations of 8, 9, and 10% (v/v) were generally preferred by panelists. The panelists preferred the taste of ginger drink with a concentration of 9%, but the aroma was not preferred. The panelist's acceptance of the color of the ginger drink at concentrations of 8, 9, and 10% was not significantly different. At the same time, the taste and aroma were significantly different at different concentrations of ginger (Prihantini 2003). Based on these problems, this study aims to increase the acceptability of cascara brewing by adding ginger extract with different concentrations on the sensory quality of ginger cascara drink.

EXPERIMENTAL SECTION

Materials

The materials used in this study were dried Arabica coffee skin (cascara) obtained from farmers in the Central Aceh district, ginger obtained from the market in Banda Aceh city, mineral water, sugar, and aquadest. Sensory test materials used are crackers and mineral water.

Experimental design

This research was conducted at the Food and Industrial Process Engineering Laboratory and the Sensory Testing Laboratory, Department of Agricultural Product Technology, Faculty of Agriculture, Syiah Kuala University, Banda Aceh. This study used a non-factorial Completely Randomized Design (CRD) consisting of 4 ginger extract concentration treatments: J0 = 0%, J1 = 3%, J2 = 6%, and J3 = 9%. Each treatment was repeated 3 times.

Procedure

Ginger Extract

The procedure for making ginger extract refers to Azni and Amelia (2019). 600 g of ginger has been sorted, cleaned, washed, and peeled. Ginger was added as much as 600 ml of water (1:1 w/v), then mashed with a blender and filtered to obtain the ginger extract. Ginger extract is cooked to a boil for 5 minutes, cooled to room temperature, and ready to be used as a mixture in ginger cascara brewing.

Cascara brewing

The cascara brewing procedure refers to Heeger et al. (2017). A total of 787.2 g of cascara was put into the container. Added 12 l of boiling water and brewed/left for 6.5 minutes. Add 71 g of sugar and mix well. Cascara is then filtered, and the resulting filtrate is called cascara brewing.

Making Cascara Ginger Drink

The process of making cascara tea with the addition of ginger extract with different concentrations was carried out as follows: 0% (J0), 3% (J1), 6% (J2), or 9% (J3) ginger extract (according to treatment) was put into a 1-liter measuring cup. Next, add freshly brewed cascara tea until it reaches 1-liter.

Product Analysis

The analysis carried out is the analysis of the pH and sensory values of the product. The pH analysis was carried out using a pH meter (AOAC 1995), while the sensory test was carried out with a hedonic test for color, aroma, and taste (Cao et al. 2021). The hedonic test was carried out by 30 semi-trained panelists in the Sensory Laboratory. The rating scale is stretched from 1 to 7 with a value of 1, which means very dislike; a value of 2, which means do not like it; a value of 3, which means rather dislike; a value of 4, which is normal, and value 5 which means rather like it, value 6 which means like, a value of 7 is like very much. The best treatment was determined based on a ranking test by weighting all hedonic sensory test parameters (color, aroma, and taste). Each treatment is given a value (weight) according to the established ranking.

Data analysis

Data from pH analysis and hedonic test were analyzed statistically using analysis of variance. If the treatment had a significant effect, it was further

tested with the Duncan Multiple Range Test (DMRT) at the 5% level.

RESULTS AND DISCUSSION

pH value

The pH values obtained in this study ranged from 4.16 to 4.35. The results of variance showed that the concentration of ginger extract had a very significant effect (P≤ 0.01) on the pH value of the cascara drink, as shown in Figure 2. The DMRT test results showed that all ginger extract concentration levels significantly differed from the pH value. The lowest pH value was in the treatment of 0% ginger concentration (J0), and the highest was in the treatment of 9% ginger concentration (J3). Based on Figure 2, it can be seen that the pH value increases with the increase in the concentration of added ginger extract. The highest pH value was obtained in the addition of 9% ginger extract, followed by 6% and 3%, which means that the acidity of the cascara drink decreases with the addition of ginger extract.

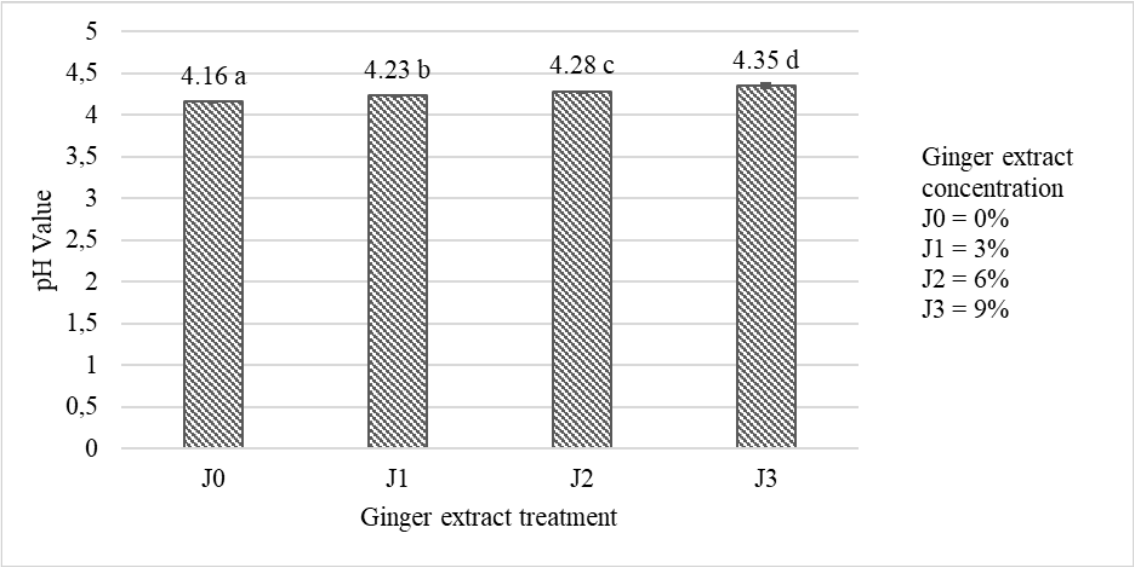

Figure 2 Effect of ginger extract concentration on pH value of cascara brewing (number values followed by different letters indicate differences in the DMRT0.05 test).

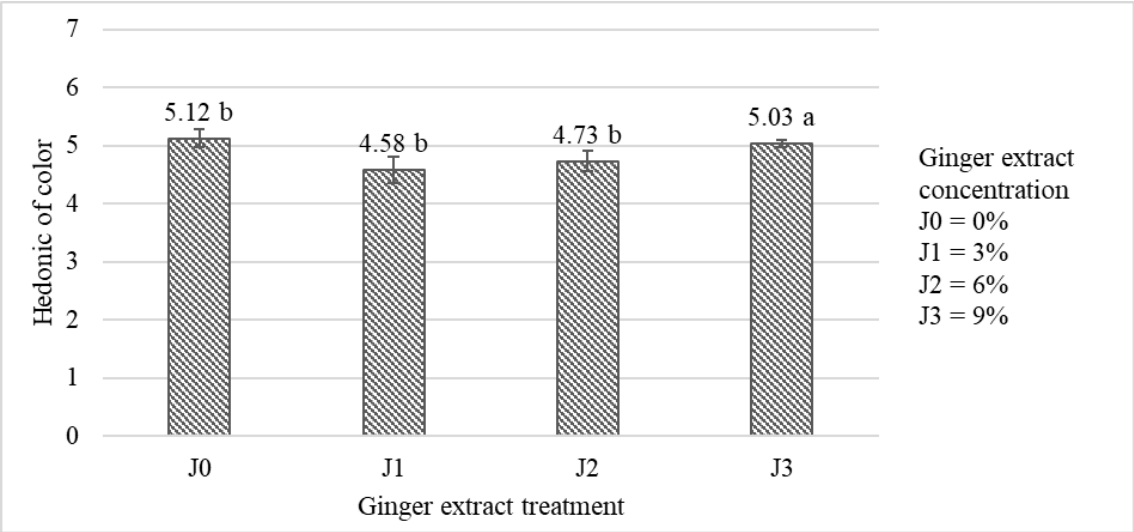

Figure 3 Effect of concentration of ginger extract on the hedonic value of the color of cascara brewing (number values followed by different letters indicate differences in the DMRT0.05 test). Means of value: 1 = very dislike, 2 = do not like, 3 = rather dislike, 4 = normal, 5 = rather like, 6 = like, and 7 = like very much.

The pH value increased because the total acid in the cascara brewing was thought to be higher than the total acid contained in the ginger extract. Total acid is positively correlated with the pH of a material. According to Cao et al. (2021), the pH value of brewing water partly improves the taste and aroma quality of tea infusion. The results of Muzaifa et al. (2020) research stated that cascara has a pH of around 4.48, while ginger extract has a pH of 6.05 (Anggista et al. 2019). It is clear that with the addition of ginger, the pH will be higher.

The pH value of cascara brewing without the addition of ginger extract (J0) is lower than cascara brewing with the addition of ginger (J1, J2, and J3), presumably because cascara contains several organic acids such as citric, malic, quinic, and chlorogenic acids. Chlorogenic acid is the most abundant organic acid found in coffee beans (6.88% - 7.17%) (Ginz et al. 2000; Farah and Donangelo 2006). Ginger oleoresin plays a role in the formation of spicy taste. The components in ginger oleoresin consist of gingerol and zingiberen, shogaol, essential oil, and resin (Anggista et al. 2019). This oleoresin component is suspected to affect the pH of the resulting ginger cascara drink.

Hedonic test

Color parameter

The color hedonic values obtained ranged from 4.58 (like) to 5.12 (very much like). The results showed that the concentration of ginger extract had a very significant effect ($P \leq 0.01$) on the hedonic color of the cascara drink. The effect of adding ginger extract on the hedonic color of the cascara drink can be seen in Figure 3.

The results of the DMRT test showed that the treatment level of 0% (J0) of ginger extract concentration was preferable to concentrations of 3% and 6% but not in 9% ginger extract. Adding 3% and 6% ginger extract causes turbidity in cascara brewing, making it less desirable. The color of cascara brewing without adding ginger extract is preferred because its appearance is similar to the general one, which is clear and brown. However, with an increasing concentration of ginger, the preference for cascara brewing with ginger color increased again (Figure 4). The results align with the research results of Adesokan et al (2013), who reported that the color sensory attributes of *Hibiscus sabdariffa* were enhanced by using ginger and garlic. The mixing aims to produce drinks with better sensory perception. Makanjuola and Enujiugha (2017) also reported that offering ginger extract by 3% increased the acceptability of ginger tea drinks compared to ginger drinks or cascara brewing.

The catechin pigment influences the brown color of the cascara brew. The more ginger extract is added, the lower the catechin content. So, the color of the ginger tea syrup produced is brown today. The panelists' preference for the color of cascara tea, which was added with 9% ginger extract, was higher than that which was added with 3% ginger extract because the 9% ginger cascara tea drink had a color that was not too dark or had less catechin content (Sukarminah and Listanti 2003)

Figure 4 Cascara brewing with the addition of ginger extract 0% (J0), 3% (J1), 6% (J2) and 9% (J3)

Aroma parameter

The aroma hedonic values obtained ranged from 4.42 (like) to 5.17 (very much like). The results showed that the concentration of ginger extract had a very significant effect ($P \leq 0.01$) on the aroma of the cascara drink, as shown in Figure 5. The DMRT results showed that each concentration of ginger extract affected the aroma of ginger cascara tea. Treatment J0 with 0% ginger concentration differed from treatments J1 and J2, which also differed from treatments J0 and J3. It was due to a large increase in the concentration of ginger extract, which was added higher than the panelists' favorite aroma.

Cascara brewed drinks generally have a slightly sour aroma, like the aroma of dried fruit cherries. Adding ginger extract at various concentrations (3, 6, and 9%) affected the aroma of the resulting cascara brewed drink. According to Jolad et al. (2005), the ginger rhizome contributes to providing aroma to drinks because it has a characteristic aroma and a distinctive spicy taste. The ginger extract contains several volatile compounds such as zingiberene and zingiberol, and the aroma of these compounds gets stronger with the increasing concentration of ginger in cascara brewing (Anggista et al. 2019).

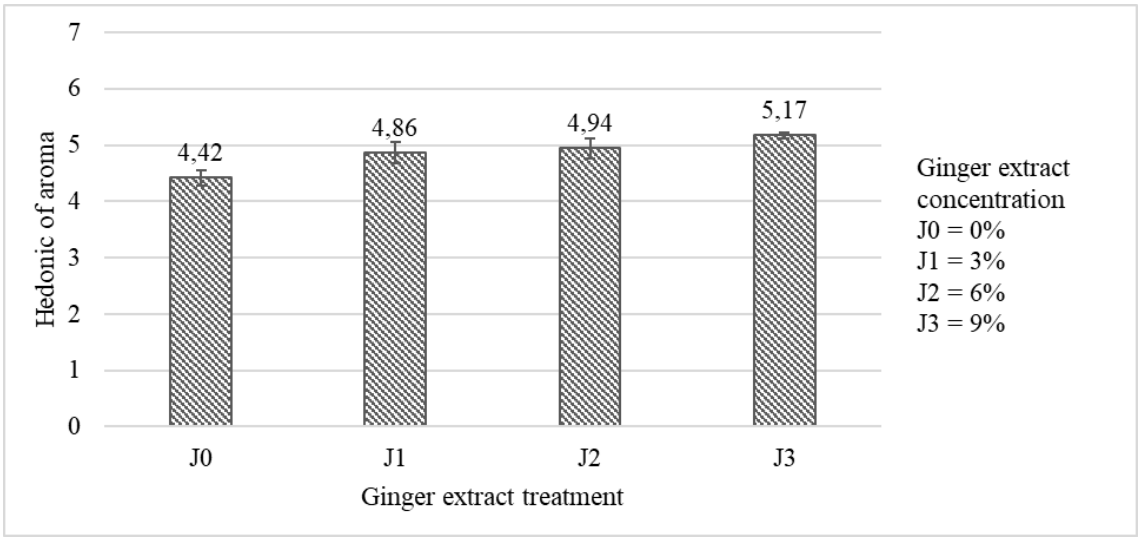

Figure 5 Effect of concentration of ginger extract on the hedonic value of aroma of cascara brewing (number values followed by different letters indicate differences in the DMRT0.05 test). Means of value: 1 = very dislike, 2 = do not like, 3 = rather dislike, 4 = normal, 5 = rather like, 6 = like, and 7 = like very much

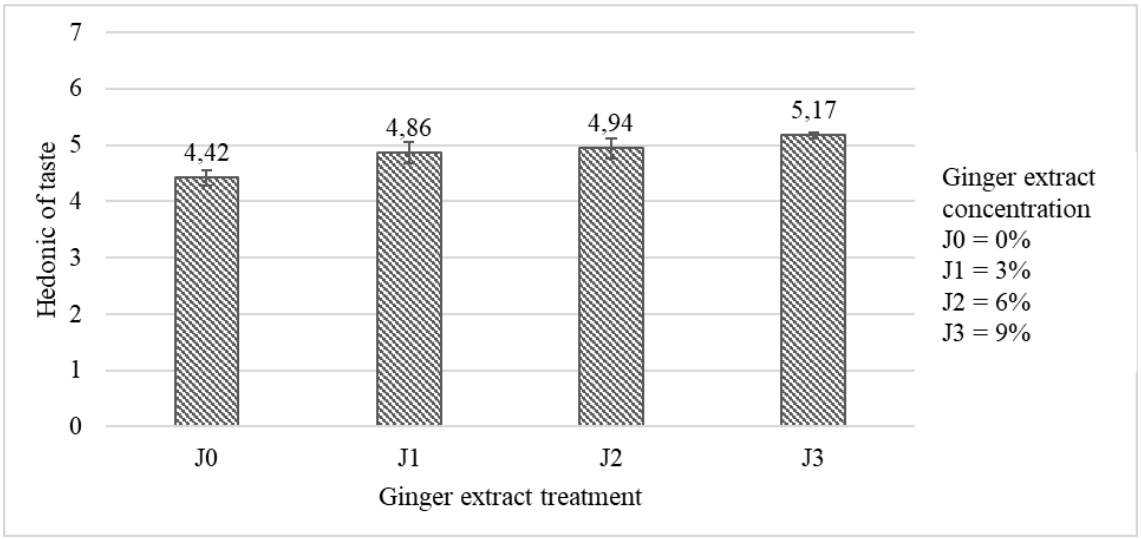

Figure 6 Effect of concentration of ginger extract on the hedonic value of taste of cascara brewing (number values followed by different letters indicate differences in the DMRT0.05 test). Means of value: 1 = very dislike, 2 = do not like, 3 = rather dislike, 4 = normal, 5 = rather like, 6 = like, and 7 = like very much.

Taste parameter

The results showed that the concentration of ginger extract had a significant effect ($P \leq 0.05$) on the hedonic taste of the ginger cascara drink. The average results of the hedonic test for the taste of the ginger cascara drink can be seen in Figure 6. The DMRT test results showed that the ginger extract treatment level of 0% (J0) was less favorable than the ginger extract concentration of 3%, 6%, and 9%. The DMRT test results also showed that the ginger extract concentration of 3% was different from the 6%. The panelists' preference level for the taste of ginger cascara drink was the lowest: the treatment with 0% ginger concentration (J0) and the highest concentration of 9% (J3).

In general, cascara brewing has a fruity taste with a blend of rose, cherry, raisin, mango, and tobacco aromas. However, adding ginger extract gives a new flavor to cascara brewing. Because the addition of ginger extract gives a distinctive spicy taste, and the higher the concentration of the added extract, the more the panelists like the taste of ginger cascara tea. The distinctive spicy taste of ginger arises due to gingerol and shogaol compounds in ginger (Jayanudin et al. 2019). Jayanudin et al. (2019) stated that mixing ginger

in drinks is expected to contribute better to the taste and aroma of drinks.

Best Treatment

The best treatment was determined based on the sensory test results using a weighted ranking (Table 1). The best treatment was obtained in sample J3: the cascara drink brewed with 9% ginger extract. The hedonic average in aroma and taste, treatment J3, gave the highest value weight. These results indicate that adding ginger extract can improve the taste of ginger cascara brewing. Following the research by Setiawan and Pujimulyani (2018) regarding white turmeric instant drinks with adding ginger extract. The higher the concentration of ginger extract added, the higher the panelists' preference for the product. It due to the components of chemical compounds such as volatile compounds, zingiber, and zingiberin, which give a distinctive spicy taste to ginger drinks (Anggista et al. 2019).

CONCLUSION

Ginger extract concentration treatment has increased the quality sensory of cascara brewing. The highest pH value, aroma, and taste of cascara brewing were obtained by adding ginger with a concentration of 9%. Adding ginger with a concentration of 9% was the best treatment.

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