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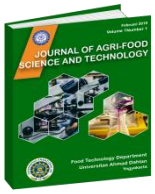

The Effect of Breadfruit Leaves (*Artocarpus altilis*) Addition to Antioxidant Content and Organoleptic Properties of Ginger Wedang

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ABSTRACT

Ginger breadfruit leaves wedang is a functional beverage made from breadfruit leaves that contains high antioxidant value, ginger and palm sugar. Moreover the adding healthy value function in ginger breadfruit leaves wedang product, also to utilizing the breadfruit leaves into functional beverage of ginger breadfruit leaves wedang in order to be accepted by the people. This research aims to know 4%, 5% and 6% breadfruit leaves addition influence to antioxidant content (gallic acid, quercetin and kaempferol) and organoleptic properties. This experiment research using Completely Random Design (CRD) with three kinds of treatment. The analyzed data using One Way ANOVA, if the treatments shows difference significant, then the analyzed data should be proceed by Duncan's Multiple Range Test with 5% confidence interval. The highest value of gallic acid antioxidant contect leads in 6% ginger breadfruit leaves wedang about 92,326 µg/ml. The highest value of quercetin antioxidant contect leads in 6% ginger breadfruit leaves wedang about 36,767 µg/ml. The highest value of kaempferol antioxidant contect leads in 6% ginger breadfruit leaves wedang about 25,921 µg/ml. The highest score of color hedonic is 3,97, and the highest score of taste hedonic is 3,67. The highest score of color hedonic quality is 3,11 with dark brown color criteria. The highest score of taste hedonic quality is 4,17 with a bit bittersweet taste criteria.

1. INTRODUCTION

The natural substance variety in Indonesia, can be used as a functional product. This is due to a large number of nutrients and non-nutritional compounds contained in the natural ingredients. All food products that have health benefits can be said to be a food or a functional beverage. Indonesia is known for traditional culinary itself, one example of the traditional beverage is wedang. Generally, wedang is made from ginger, cinnamon, secang, nutmeg, clove, and pandan leaves that have been known as various herbs that can be used for health (Yunita, 2012). Ginger wedang is one example of a popular beverages in Indonesia. Ginger wedang is a hot drink that added ginger and palm sugar. A study published by the National Center for Biotechnology Information (2013) mentions that gingerol is proven to be an anti-inflammatory, anti-diabetic, anti-cancer, gingerol is also shown to possess good antioxidant properties.

One of the underutilized plants is breadfruit leaves. According to Rizqi (2014), one of the potential food ingredients to be developed into an alternative functional beverage is the breadfruit (*Artocarpus altilis*) leaves. According to Utami (2013), the most commonly used from breadfruit crops as an herbal remedy is the leaves because it contains quercetin, kaempferol, and artoindonesianin which are groups of flavonoids compounds. The research use breadfruit leaves that will be added to the functional beverage of ginger wedang because of the many antioxidant contents founds. This research aims to determine the influence of breadfruit on antioxidant content (gallic acid, quercetin, and kaempferol) and organoleptic properties. Besides, this research also make breadfruit leaves become a beverage of ginger leaves breadfruit that will be accepted by peoples, also the breadfruit leaves made with a formula that safe to be consumed.

2. MATERIALS AND METHODS

2.1. Materials

The treatments in this research is 4%, 5% and 6% difference of breadfruit leaves addition with two repetitions. The ginger breadfruit leaves *wedang* ingredients formula is breadfruit leaves, ginger, palm sugar and water. The material to make ginger breadfruit leaves *wedang* is digital scales, measuring cups, cutting board, bowls, knives, spoons, pans, and temperature measurement. The functional beverages ginger breadfruit leaves *wedang* formula can be seen in Table 1.

Table 1. Ginger Breadfruit Leaves *Wedang* Formula

Ingredients	Formula 4%	Formula 5%	Fornula 6%
Breadfruit leaves	40 g	50 g	60 g
Ginger	25 g	25 g	25 g
Palm sugar	50 g	50 g	50 g
Water	1000 ml	1000 ml	1000 ml

Source: Satriati, (2007) dan Researchers Modification

2.2. Research Methods

In ginger *wedang* with 4%, 5% and 6% breadfruit leaves addition carried out research that includes antioxidant content (gallic acid, quercetin and kaempferol) using HPLC method, organoleptic properties consisting of hedonic tests and hedonic quality tests include color and flavor using instrument with 1-5 score range.

The analyzed data using One Way ANOVA with an equivalent significance of 5%. When the significance of $P < 0,05$ is stated there is a significant difference. If the treatments show difference significant, then the analyzed data should be proceeded by

Duncan's Multiple Range Test (DMRT) with a 5% confidence interval.

3. RESULT AND DISCUSSION

3.1. Antioxidant Content

The antioxidant content (gallic acid, quercetin, and kaempferol) of functional beverages ginger breadfruit leaves *wedang* can be seen in Table 2.

Table 2. Antioxidant Content of Ginger Breadfruit Leaves *Wedang*

Treatments	Gallic acid µg/ml	Quercetin µg/ml	Kaempferol µg/ml
4%	72,879	29,922	20,226
5%	81,958	32,215	22,584
6%	92,326	36,767	25,921

3.1.1. Gallic acid

The gallic acid analysis result from the three formula of ginger wedang with different breadfruit leaves addition, indicate a noticeable difference. The ginger wedang result with 6% of breadfruit leaves addition contains the highest gallic acid content about 92,326 µg/ml or 0,092 mg/ml. This indicates leads the more of breadfruit leaves we used, the higher of gallic acid value obtained. According to Utami, et al. (2015), breadfruit leaves as much as 3,76 kg that has been dissolved with ethanol contained 52,67 mg gallic acid per 3,76 kg of fresh leaves or 14 mg/mg.

The gallic acid in ginger also contributes to gallic acid content in a functional beverage of ginger breadfruit leaves *wedang.* Research by Kusumaningati (2009) mentioned that the content of gallic acid in ginger (*Zingiber officinale* Rosc.) amount 92,98 mg/100g of fresh ginger. In ginger breadfruit leaves *wedang* used 25 gr of ginger, therefore the gallic acid value in ginger is contained 0,023 mg/ml. According to Daneshfar, et al. (2008) research mentions that gallic acid can dissolve in methanol, ethanol, water, and ethyl. The solvent in this research is water, the gallic acid compounds in functional beverages of ginger breadfruit leaves *wedang* can be optimally dissolved due to the type of solvent used were suitable with the soluble properties of gallic acid.

3.1.2. Quercetin

The quercetin analysis result from the three formula of ginger wedang with different breadfruit leaves addition, indicate a noticeable difference. The ginger wedang result with 6% of breadfruit leaves addition contains the highest quercetin content about 36,767 µg/ml or 0,037 mg/ml. This indicates leads the more of breadfruit leaves we used, the higher of quercetin value obtained. According to Utami, et al. (2015), breadfruit leaves as much as 3,76 kg that has been dissolved with ethanol contained 5,05 mg quercetin per 3,76 kg of fresh leaves or 1,3 mg/mg.

The quercetin in ginger also contributes to quercetin content in a functional beverage of ginger breadfruit leaves *wedang*. Research by Ali, et al. (2018) mentioned that the content of quercetin in ginger (*Zingiber officinale* Rosc.) amount 40,25 ± 0.21 mg/g. In ginger breadfruit leaves *wedang* used 25 gr of ginger, therefore the quercetin value in ginger is contained 1,0 mg/ml. Research by Widiati (2011) mentioned that quercetin is insoluble in water and ether, but can be soluble in alcohol and acetone. Research by Utami, et al. (2015) using ethanol for the solvent, thus the quercetin compounds in breadfruit leaves can be optimally dissolved. The solvent in ginger breadfruit leaves *wedang* is water, thereby the

quercetin can not be optimally dissolved. Therefore the quercetin in ginger breadfruit leaves wedang has the lowest value due to the type of solvent used were not suitable with the soluble properties of quercetin.

3.1.3. Kaempferol

The kaempferol analysis result from the three formula of ginger wedang with different breadfruit leaves addition, indicate a noticeable difference. The ginger wedang result with 6% of breadfruit leaves addition contains the highest kaempferol content about 25,921 μg/ml or 0,026 mg/ml. This indicates leads the more of breadfruit leaves we used, the higher of kaempferol value obtained.

The kaempferol in ginger also contributes to kaempferol content in a functional beverage of ginger breadfruit leaves wedang. Research by Lim (2016) mentioned that the content of kaempferol in ginger (*Zingiber officinale* Rosc.) amount 54 mg/g. In ginger breadfruit leaves *wedang* used 25 gr of ginger, therefore the kaempferol value in ginger is contained 1,35 mg/ml. Research by Calderon, et al. (2011) mentioned that the kaempferol is insoluble in water, but can be soluble in ethanol and dietil ether. The solvent in ginger breadfruit leaves *wedang* is water, thereby the kaempferol can not be optimally dissolved. Therefore the kaempferol in ginger breadfruit leaves *wedang* has the lowest value due to the type of solvent used were not suitable with the soluble properties of kaempferol.

3.2. Organoleptic Properties

The organoleptic properties (hedonic and hedonic quality) of functional beverages ginger breadfruit leaves *wedang* can be seen in Table 3.

Table 3. Organoleptic Properties of Ginger Breadfruit Leaves *Wedang*

Treatments	Organoleptic Properties	Color	Taste
4%	Hedonic	3,70	3,21
5%		3,97	3,67
4%	Hedonic quality	3,11	2,30
5%		2,60	1,83

3.2.1. Color Hedonic

The panelists color hedonic result of ginger breadfruit leaves wedang with 4% and 5% breadfruit leaves addition has an average score of 3,70 and 3,97 have the same level as brown color criteria. The panelist more interested in 4% and 5% formula of ginger breadfruit leaves wedang. Whereas the ginger breadfruit leaves wedang with 6% breadfruit leaves addition has an average score of 3,29 with soft brown color criteria. The panelists give the reason that all colors tend to be the same (brown color). This is due to the use of palm sugar which causes the color of ginger breadfruit leaves wedang to become brown. That is because the palm sugar gives the dominant color, so the panelist judging the color of the three formulas (4%, 5%, and 6%) tend to be the same. However, the panelist test result shows the more interested in ginger breadfruit leaves wedang is brown color.

3.2.2. Taste Hedonic

The panelists taste hedonic result of ginger breadfruit leaves wedang tend to like the 5% breadfruit leaves addition with a bit bittersweet taste criteria. The bitter taste of ginger breadfruit leaves *wedang* can be influenced by ginger. Besides,

the bitter taste also caused by the breadfruit leaves, because breadfruit leaves contain tannin (Somashekhar, dkk., 2013) that can give the bitter taste and the astringent compound that has a bitter taste. The panelist more interested in 5% breadfruit leaves addition with a score of 3,67. This is suspected because the different types of panelists towards the breadfruit leaves taste. Moreover, the third formulation with 6% breadfruit leaves addition using more leaves. As well as in the first formulation with 4% breadfruit leaves addition using fewer leaves. The panelists give the neutral result, because the second formula with 5% breadfruit leaves addition is in the middle between 4% and 6% breadfruit leaves addition, thus making the second formula as the product most widely liked by the panelist.

3.2.3. Color Hedonic Quality

The functional beverage of ginger wedang with 4% breadfruit leaves addition has the highest score of 3,11. The color hedonic result of ginger breadfruit leaves wedang with 4% and 5% breadfruit leaves addition have the same level as brown color criteria, and with 6% breadfruit leaves addition is soft brown color criteria. The brown color from ginger breadfruit leaves *wedang* influenced by the color of palm sugar, because palm sugar has reddish-brown to dark brown color. The palm sugar itself gives the dominant color so it tends has no different color from the three formula of ginger breadfruit leaves *wedang.* Besides, the other ingredients which able to give the effect of discoloration are breadfruit leaves and ginger. It is known because the concentrated of breadfruit leaves color change into reddish-brown when through the blanching process. And the concentrated of ginger color change into pale yellow when through the boiling process.

3.2.4. Taste Hedonic Quality

The functional beverage of ginger wedang with 5% breadfruit leaves addition has the highest score of 4,17. The taste hedonic quality result of ginger wedang with 5% breadfruit leaves addition is a bit bittersweet criteria, and different with 4% and 6% breadfruit leaves criteria. The bitter taste in ginger breadfruit leaves *wedang* is slightly struck by ginger, so the bitter taste from breadfruit leaves is slightly reduced. According to Arini (2011), ginger is often used as a beverage ingredient because it has a not so spicy flavor. The sweetness taste in ginger breadfruit leaves *wedang* is due to the use of palm sugar. Besides, the panelist assessment is ginger breadfruit leaves *wedang* has a sweet taste when the first, and then the after taste is a bit bitter and slightly spicy from the ginger. The palm sugar can be used to minimize the bitter and spicy flavor.

4. CONCLUSIONS

The highest value of gallic acid antioxidant contect leads in 6% ginger breadfruit leaves wedang about 92,326 µg/ml. The highest value of quercetin antioxidant contect leads in 6% ginger breadfruit leaves wedang about 36,767 µg/ml. The highest value of kaempferol antioxidant contect leads in 6% ginger breadfruit leaves wedang about 25,921 µg/ml. The highest score of color hedonic is 3,97 with 5% breadfruit leaves addition. The highest score of taste hedonic is 3,67 with 5% breadfruit leaves addition. The highest score of color hedonic quality is 3,11 with brown color criteria in 4% breadfruit leaves addition. The highest score of taste hedonic quality is 4,17 with a bit bittersweet taste criteria in 5% breadfruit leaves addition.

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