Antioxidant Level and Sensory of Dragon Fruit (*Hylocereus undatus*) Peel Tea Infusion Made by Partially Fermented Process

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Abstract

Dragon fruits are usually consumed by people directly or being processed into juice. Therefore, the major by-product of dragon fruits is the peel. As by-product, dragon fruit peels have higher antioxidant level than pulp especially for White Dragon Fruits (Hylocereus undatus). This research is carried out in order to evaluate the antioxidant level and sensory of dragon fruit peel tea which produced through a partially fermented process. The objective of this research is to investigate the effect of withering time and rolling time on antioxidant level and sensory of dragon fruit peel tea. Withering time varied in 30, 60, and 120 min while the rolling time varied in 10, 20, and 30 sec. 2, 2, diphenyl-1-picrylhydrazil (DPPH) assay showed that radical scavenging activities of dragon fruit peel tea infusion increased with the longer withering time and shorter rolling time. Likewise the total phenol content (TPC) assay demonstrated the amount of phenol increased with the longer withering time and shorter rolling time. There were found that the dragon fruit peel had 29.58% in proportion compared with the whole fruit and vitamin C content in the peel higher than that in the pulp. The longer withering time and shorter rolling time will increase the phenol total content, antioxidant activity, and the lightness color, but decrease the acidity degree of tea infusions. In addition, the withering time was 120 min and rolling time was 10 sec had higher Antioxidant activity 41.19% and the total phenol 55.93 mg/L.

Key words: *Dragon fruit peel tea, antioxidant activity, total phenol content.*

1. INTRODUCTION

Herbal tea is a terminology for concoction produce from flower, leaf, seed, root, stalk, fruit, and fruit peel which is dried and used to make herbal drink. It does not contain tea leaf (*Camellia sinensis)*, even though it is recognized as the "tea". Herbal tea is considered as the one of antioxidant source alternatives, and antioxidant in the herbal tea plays a very important role for healthy diet because natural antioxidant contains vitamins A, B6, C, E, polyphenol (Xavonoid, Xavanol, Xavonol, isoXavone, quercetin, catechin, epicatechin, etc.), co-enzimeQ10, carotenoid, selenium, zinc and phytochemical (Atoui, *et al.* 2005). All of these proven that Herbal tea is the most important tools as the alternative to prevent and rescues the diseases. So, it is undeniable that herbal tea has more advantages that may its increase the herbal tea consumption.

Dragon fruit or pitaya is one of the tropical fruits under the cactus family and Cactaceae. It comes from Mexico, Central America, and South America. However, nowadays they are also cultivated in Asia such as Taiwan, Vietnam, Filipina, Malaysia, and Indonesia. In Asia is recognized as the Dragon fruits since the peels like dragon scales (Nerd *et al.*, 1999). Dragon fruits offer variety taste particularly its delicious taste for the pulp and also a good character in the peel. In Indonesia, especially in Jogjakarta, dragon fruits are inculcated at Glagah Beach area, Kulon Progo. The productive period of dragon fruit tree is in September-May, in which one pole of tree consists of 5-6 branches produce 150-200 kg dragon fruits.

Dragon fruits are commonly consumed directly or processed into juice, jam, syrup, and other products. However, by-product of dragon fruits have not optimally used even though the

dragon fruit peel has 22% in proportion compare with the whole fruit and have most of polyphenol which is the source of antioxidant as well as every 100 g of dragon fruit peels contain 150.46 mg betacyanin pigment in terms of the reason; they can be used as herbal tea which contains of the most antioxidant made by partially fermented processing. Dragon fruit peels are developed as the herbal tea is expected to decrease the fruit waste.

Tea contains biochemistry bounding which call polyphenol, and polyphenol is a group of the natural antioxidant find in vegetables, fruits, and beverages like tea and wine (Pambudi, 2004). The polyphenol function is to avoid the oxidation process and free radical. All antioxidant compounds can act as substances that delay or prevent the oxidation of cellular oxidisable substrates caused by reactive oxygen species (Ajila, *et al.*, 2007). The main principle of antioxidant activity is the availability of electrons to neutralize any free radicals. Free radicals which are produced during the oxidation process extremely reactive and have the potential to damage transient chemical species. Among the most abundant antioxidant compounds in tropical fruits are carotenoids, phenolics and betalains. According to Park *et al.* (2008), polyphenol is recognized as the phenolic compounds and plays the main role in contributing to the overall antioxidant activity.

This research is carried out in order to eva luate the antioxidant level and sensory of the dragon fruit peel tea which produces through a partially fermented processing. The objective of this research is to investigate the effect of wi thering time and rolling time on antioxidant level and sensory of dragon fruit peel tea.

2. MATERIALS AND METHODS

2.1. Sample collection

Dragon fruit used as the main materials in present study is white dragon fruit (*Hylocereus undatus*). They were purchased from Kusuma Wanadri, Dragon Fruit's plantation, Bantul, Indonesia.

2.2. Sample preparation

Dragon fruits were washed and wiped dry. The whole fruits were measured and peeled in order to separate the peels from the pulps for further tests. Each part, both peels and pulps, were measured to be known the proportion of the peel compared the whole fruit. The peels of dragon fruits were stored at 4°C until further used.

2.3. Proximate Analysis.

Proximate analysis such as moisture, ash, fat, protein content and vitamin C in the pulps and peels were determined using method by AOAC International.

2.4. Semi Fermented Tea Production.

The Peels of dragon fruit were chilled before tea production. There are three steps to produced dragon fruit peel's tea. First, the peels were withered in order to reduce the moisture content and prepare the peels to the next step. Withering time varied in 30, 60, and 120 min. Second, the peels were rolled to make the bruise peels and damage the cell wall. While the cell liquid out evenly on the peels surface, it is already happening enzymatic oxidation or fermentation. The rolling time varied in 10, 20, and 30 sec. Fermentation process occurred in short time so the antioxidant content was not oxidized. The observed results were rolling appearance and total phenols in the tea infusion. Third, drying aimed to reduce the moisture content reaches 3-5%. As well as to facilitate the storage and maintain the specific properties of tea.

2.5. Determination of Total Phenolic Content.

Total phenolic content was determined according to the method of Andarwulan *et al.* (1999). Tea infusion was made by extracted 5g of dragon fruit peel tea with 250 ml aquadest. Samples (0.05 mL) were measured into test tubes followed by 0.5 mL of Folin-Ciocalteu's reagent (50%), 5 mL aquadest, 1 mL ethanol. The tubes were vortexed, covered with parafilm and allowed to stand 5 min. The tubes were added 1 mL of sodium carbonate (5% w/v). The tubes were vortexed and allowed to stand for 60 min. Before absorbance at 725 nm. A standard calibration curve was prepared using gallic acid dilution which was made in

many concentrations and measured same as the sample.

2.6. Antioxidant Activity Determination (DPPH Method).

The scavenging activity on DPPH radical of dragon fruit peel tea infusion was determined by modifying the methods of Gadow *et al*. (1997). Tea infusion was made by extracted 5 g of dragon fruit peel tea with 250 ml aquadest. The extracts (0.1 mL) were measured in tube mixed with 3 mL ethanol and 1 mL DPPH reagent**.** DPPH solution was prepared with dissolved DPPH in ethanol and adjusted to a final DPPH concentration of 400 µM. The tubes were vortexed, covered with parafilm and allowed to stand for 20 min. Absorbance at 517 nm. The radical-scavenging activity was calculated as % inhibition from the following equation:

$$\%\text{Inhibition} = \frac{OD_{blank} - OD_{sample}}{OD_{blank}} \text{ X } 100$$

3. RESULTS AND DISCUSSION

3.1. Comparison of Portion between Peels and Whole Fruits.

The whole fruits and peels were measured in order to know the proportion of each part. In addition, how many peels were produced will show how much the potentiality of the dragon fruit peels use.

Table 1. Summary of the Average Weight of Dragon Fruit Part

Fruit part	Weight (g)
Whole fruit	352.117±24.65
Pulp	247.600±12.38
peel	103.633±8.29
scrap	0.884±0.06

Table 1 shows the proportion of the whole fruits and peels. The peels take 29.58% from the whole fruits. It is shown that the peels have a lot of potential to be developed further. In addition, Nerd, A., F. Gutman, and Y. Mizrahi (1999) reported that dragon fruit peels have 22% compared with the whole fruits. This means that the peels in this research presence higher portion.

3.2. Comparison of Proximate Analyses between Pulp and Peel.

Before the peels were used to produce tea, it is necessary to know the proximate content between pulps and peels. Table 2 shows the proximate content comparison between the pulp and peel.

Table 2. Summary of Proximate content every 100 g part

Nutritional Content	Pulp	Peel
Moisture (g)	86.35	90.27
Protein (g)	0.23	0.16
Ash (g)	0.8	2.15
Fat (g)	7.16	3.77
Carbohydrate (g)	5.46	3.65
Vitamin C (mg)	46.93	93.87

As shown in Table 2, the protein, fat, and carbohydrate content in pulp higher than peel. However, the moisture, ash, and vitamin C content in pulp lower than peel. The vitamin C content in peels was almost twice from the pulp.

3.3. Acidity Degree of Tea Infusion

Commonly, herbal tea is acidic so that it is needed to measure the acidity degree. The acidity degrees of Dragon Fruit Peel infusion were shown in figure 1.

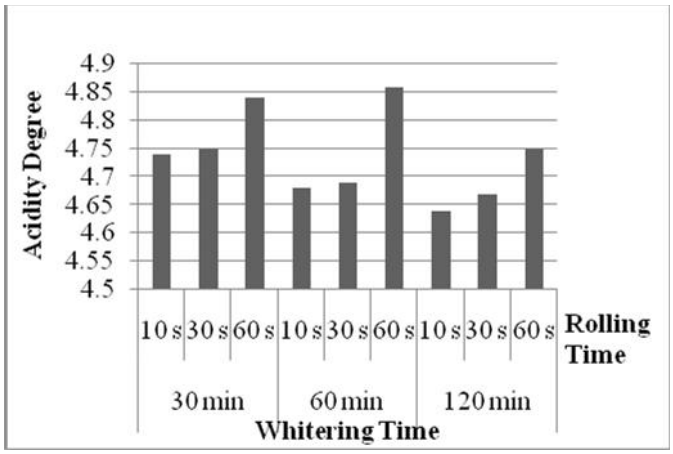

Figure 1. Acidity Degree of Dragon Fruit Peel's Tea Infusion.

The acidity degrees increase by the longer time of withering and shorter time of rolling. The longer time of withering decreased more peel's moisture. It was causing the releasing moisture and ascorbic acid content during the rolling would decrease too. In addition, the ascorbic acid was oxidized during the short fermentation time. The preference's consumer scores indicated that withering time of 30 min and rolling time of 10 s had significantly ($P < 0.05$) the highest mean score, followed by withering time of 30 min and rolling time of 30 s, and withering time of 120 min and rolling time of 10 s (Table 4).

3.4. The Color of Dragon Fruit Peel's Tea infusion.

The tea's infusion color was determined using a Minolta Colorimeter Model CR-200. The dimensions L*, a*, and b* were obtained. The infusion's color appeared as the effect of spontaneous fermentation after the rolling time. The good fermentation process will produce the bright and well apparent of tea's infusion (Arifin, 1994).

Table 3. Summary of Tea's Infusion Color

Withering Time	Rolling Time	Color		
		L	a	b
30 min	10 s	12.14^{bc}	1.35^{cd}	0.14^{bc}
	30 s	12.39^{bc}	1.29^{abc}	0.27^{a}
	60 s	12.20^{bc}	1.32^{bcd}	-0.14^{ab}
60 min	10 s	12.43^{c}	1.25^{ab}	-0.14^{ab}
	30 s	12.20^{bc}	1.31^{bcd}	0.23^{c}
	60 s	12.25^{bc}	1.30^{abc}	-0.03^{abc}
120 min	10 s	12.43^{c}	1.21^{a}	0.09^{bc}
	30 s	11.76^{a}	1.40^{d}	0.05^{bc}
	60 s	12.01^{ab}	1.36^{cd}	0.08^{b}

(Means within the same column that do not have the same superscript (a–c) are statistically different ($P < 0.05$)).

Table 3 shows the infusion's color of Dragon Fruit's peel tea. L* shows the lightness of the infusion's color. Lightness values varied among the tea infusions extracts. The higher L* value means the infusion's color is lighter. The lightest color was happened at the withering time of 60 min and rolling time of 10 s also withering time of 120 min and rolling time of 10 s. The preference's consumer scores indicated that withering time of 60 min and rolling time of 10 s had significantly ($P < 0.05$) the highest mean score, followed by withering time of 60 min and rolling time of 20 s, and withering time of 120 min and rolling time of 10 s (Table 4).

Table 4. Mean Score Values for Preference Attributes of Dragon Fruit Peel's Infusions.

Withering Time	Rolling Time	Color	Acidity	Aroma
30 min	10 s	-1.6^{a}	0.2^{c}	-0.1^{a}
	30 s	-1.3^{ab}	-0.5^{bc}	0^{a}
	60 s	0.1^{abc}	0.1^{c}	0.1^{a}
60 min	10 s	0.7^{c}	-2.1^{a}	-0.2^{a}
	30 s	0.6^{b}	-1.6^{ab}	0.3^{a}
	60 s	-0.9^{abc}	-0.6^{abc}	0^{a}
120 min	10 s	0.2^{bc}	0^{c}	0.2^{a}
	30 s	-0.7^{abc}	-0.6^{a}	0^{a}
	60 s	0.2^{bc}	-0.7^{abc}	-0.2^{a}

(The sensory evaluation was carried out using consumer panel (n = 20.). Means within the same column that do not have the same superscript (a–c) are statistically different ($P < 0.05$))

Table 4 shows that there were no differences in aroma's attribute between the infusions. The consumers slightly like the infusion's aroma because of the unpleasant aroma which is the one of characteristics of cacti.

3.5. Total Phenolic and Antioxidant Activity of the Infusions.

Polyphenolic compounds were reported to be commonly found in both edible and inedible plants (Wojdylo *et al.*, 2007). Usually, the non- flavonoid compounds can be found in the pulps, while the flavonoid compounds are located in the peels, seeds and stems (Paixao *et al.*, 2007). Phenolic components were measured as the total phenol which contained in the infusion. Some typical phenolic compounds which highly correlated with antioxidant activity are phenolic acid (e.g. gallic acid) and polyphenol (e.g. flavonoids). According to Bertoncelj et al. (2007), there were several studies showing that antioxidant

activity was strongly correlated with the content of total phenolic compounds. So, it was needed to investigate the antioxidant activity from the total phenol content in dragon fruit peel tea's infusion.

Fig. 2 shows the total phenol and antioxidant activity of the tea infusions. There were no significantly different ($P<0.05$) of total phenol content, except for the infusion for tea which was produced in withering time of 120 min and rolling time of 10 s. This condition illustrates that there were a little phenolic contain which loose during the rolling time. Total phenol contained in dragon fruit peel tea infusion (223.70 mg/L) lower than the total phenol in green tea (649.33mg/L) but it was higher than the total phenol in black tea (188.00 mg/L) (Budiyati *et al.*, 2009). The total phenol of Dragon Fruit peel tea infusion lower than that of green tea was caused of the phenol total in Dragon Fruit peel tea infusion was partially fermented before the tea was dried. The antioxidant activity also had same trend as the total phenol. It was shown that antioxidant activity had positive correlation with the total phenol content.

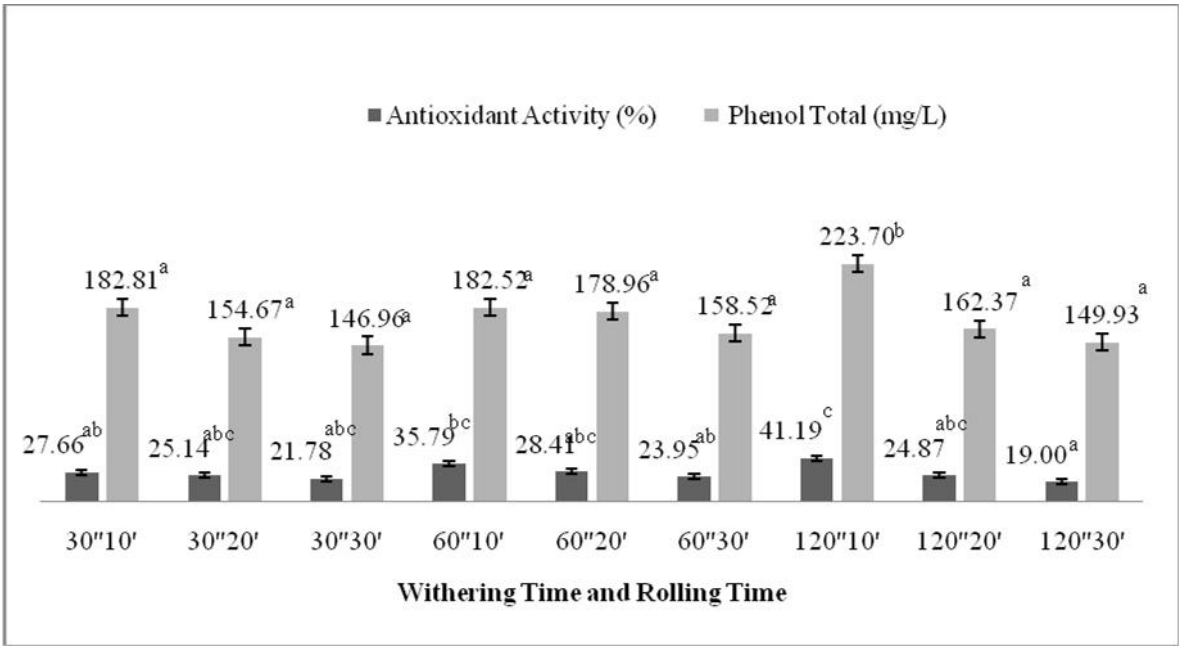

Figure 2. Phenol Total and Antioxidant Activity of the Infusions.
(Means within the same bar that do not have the same superscript (a–c) are statistically different ($P < 0.05$))

4. CONCLUSSIONS

In the present study, it was found that the dragon fruit peel had 29.58% in proportion compared with the whole fruit and vitamin C content in the peel higher than that in the pulp. The longer withering time and shorter rolling time will increase the total phenol content, antioxidant activity, and the lightness color, but decrease the acidity degree of tea infusions. Further studies of the effect of Dragon Fruit peel tea infusion consumption is necessary in the future.

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