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Comparison of Total Flavonoid Content on Fresh and Dried Fig (*Ficus carica*) Leaf with Various Brewing Temperature

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Fig (Ficus carica) has the various benefits especially for health because of its various active compounds. One of the active substances found in fig is flavonoid. The use of fig leaves in the form of teabags certainly involves the heating process when brewing. Whereas, thermal processes have a great influence on the availability of flavonoid from foods. This study aims to compare the total flavonoid content on fresh and dried fig (Ficus carica) leaf with various brewing temperature. The temperatures used for brewing vary from 60°C, 70°C, and 80°C. The total flavonoid content was determined by spectrophotometric method with the standard quercetin solution. The total flavonoid contents of fresh fig leaf brew with the brewing temperatures of 60°C, 70°C, and 80°C are 0.0031±0.00039%, 0.0081±0.00021%, and 0.0092±0.00024%. The total flavonoid contents of dried fig leaf brew with the brewing temperatures of 60°C, 70°C, and 80°C are 0.0010±0.00025%, 0.0015±0.00004%, and 0.0017±0.00018%. Based on the Two Way Anova test, it can be concluded that the brewing temperature and simplicia preparation of fig leaf (fresh and dried) significantly affect the total flavonoid content. The fig leaf brew with the highest flavonoid content is 0.0092±0.00024% obtained from brewing the fresh fig leaf at 80°C.

***Keywords**: total flavonoid content, fresh fig leaf, dried fig leaf, brewing temperature*

1. INTRODUCTION

Tin or commonly called fig (*Ficus carica*) has the various benefits especially for health because of its various active compounds. One of the active substances found in fig is flavonoid. Flavonoids have antioxidant, antiviral and antibacterial properties (Kozłowska & Dorota, 2014). They also regulate gene expression and modulate enzymatic action (Pollastri & Tattini, 2011).

Compared to fruit, the flavonoid content of fig leaf is higher. Flavonoid levels of ethanolic extract of fig leaves and fruits respectively 2.62±0.003 and 1.96±0.002 mg rutin/g (Trifunschi et al., 2015). Therefore, the researcher prefer to study the flavonoid content of fig leaf than its fruit. The main types of flavonoid found in fig leaves are quercetin and luteolin with amounts 631 dan 681 mg/kg fig leaves extracts (Vaya & Mahmood, 2006). Quercetin is the most important flavonoid which belongs to the class of flavonol which widely used in medicine and pharmaceutics. Quercetin provided many health promoting benefits, like cardiovascular properties, cancer reducing agent, anti-inflammatory, asthma and many more (Kumar, Vijayalakshmi, & Nadanasabapathi, 2017). Therefore,

determination of flavonoid contents in fig leaf brew performed with using standard quercetin solution.

The traditional and current uses of fig leaves are to treat cough, prevention of nutritional anaemia, anthelmintic, irritant potential, and tuberculosis (Mawa, Husain, & Jantan, 2013). The use of fig leaves in Indonesia is starting to widespreadly increase. Moreover, some industries have produced dried fig leaves that are packaged in the form of teabags. The use of fig leaves in the form of teabags certainly involves the heating process when brewing. Whereas, thermal processes have a great influence on the availability of flavonoid from foods. In fact, quercetin which is one of the flavonoid content in fig leaves is labile on heating (Kumar et al., 2017).

This study was conducted to compare the total flavonoid content on fresh and dried fig (*Ficus carica*) leaf with various brewing temperature. The temperatures used for brewing vary from 60°C, 70°C, and 80°C. The use of dried and fresh fig leaves was to prove whether the drying process also affects flavonoid contents.

2. Material and Methods

2.1 Material

The fig leaf used are obtained from Blimbing, Lowokwaru, Malang and tested for its authenticity in Materia Medica Batu, East Java with the determination number of 074/253A/102.7/2018. The varieties, ages, parts of leaves, and harvest time of foliage are not determined. The main tool used for the total flavonoid content determination is the UV-Vis spectrophotometer (Hitachi U-2900). The other materials used were methanol, $AlCl_3$ 2% and quercetin as a standard solution.

2.2 Methods

Fresh and Dried Fig Leaf Preparation

Fresh fig leaves are washed and then air dried and was cut with the width of about 2-3 mm. Thereafter, ± 6.25 grams the fresh fig leaf was put into 3 beaker glasses of each to be brewed. And then, ± 6.25 grams the fresh fig leaf was put into 3 evaporation plates of each to be dried with the temperature of 25-30°C with an oven until a constant weight is obtained. After that, the dried fig leaf moved into 3 beaker glasses to be brewed.

Fig Leaf Brewing

Aquadest was boiled, then cooled to a temperature of 60°C, 70 °C and 80 °C. After that, 100 mL aquadest was used to brew fresh and dried fig leaves of each. The brew obtained was closed until reaching a room temperature, then filtered.

Total Flavonoid Content Determination

Flavonoid contents of fresh and dried fig brew were determined by the $AlCl_3$ Colorimetric Method (Chandra et al., 2014) with the standard quercetin solution. The first step in determining the flavonoid levels was to determine the calibration curve of standard quercetin solution. After got the curve equation, then the sample's absorbance was plotted in the equation. In brief to determine the

absorbance of the sample, fig leaf brew was added with 4 mL of methanol then added with 1 mL of $AlCl_3$ 2%. After that, the mixture was incubated at room temperature for 30 minutes. After incubation, the absorbance was measured at a maximum wavelength of 430 nm.

Data Analysis

The data obtained were analyzed with Two Way Anova test to find out:

a. whether brewing temperature affects total flavonoid content or not,
b. whether simplicia (fresh and dried) preparation affects total flavonoid content or not,
c. whether the interactions of both (the brewing temperature and simplicia preparation) affect total flavonoid content or not.

3. RESULT AND DISCUSSION

Quercetin standard curves have been obtained with the curve equations y = 0.079x - 0.0063 and $R^2 = 0.9986$. After the absorbance of fresh fig leaf brew was plotted in the equation, the total flavonoid content was obtained and it is presented in Figure 3.1.

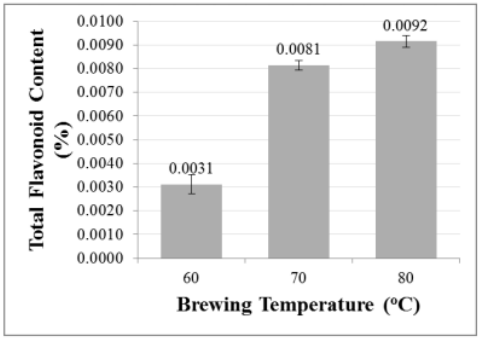

Figure 3.1 Total flavonoid content of fresh fig leaf brew

Based on the results, the largest total flavonoid content of fresh fig leaf brew obtained was from 80°C. Analyzed from the resulting diagram, from 60°C to 80°C the temperature increases the total flavonoid content. One of several factor that influences extraction speed is temperature. High temperature can increase the plant active compounds desorption due to the increase of cell damage to the material caused by the high solvent temperature (Jain, Jain, Pandey, Vyas, & Shukla, 2009).

Total flavonoid content of dried fig leaf brew also showed the same trend as fresh fig leaf brew, it is presented in Figure 3.2. The increase in temperature increases the total flavonoid content of dried fig leaf brew. This is not in line with the statement which states that thermal processes have a great influence on the availability of flavonoid from foods (Kumar et al., 2017). This means that the maximum temperature used (80°C) is a safe temperature for the flavonoid extraction process.

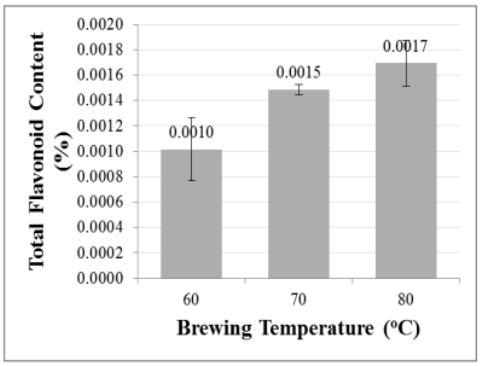

Figure 3.2 Total flavonoid content of dried fig leaf brew

Based on the comparison of results, it can be seen that brew with the highest total flavonoid content is from fresh fig leaf with a brewing temperature of 80°C. In addition, with the same brewing temperature, total flavonoid content of fresh fig leaf brew was higher than dried one. Based on previous research, the destruction of flavonoids had varied significant differences between fresh samples and dried materials. Heating may breakdown some phytochemicals which affect cell wall integrity and cause a migration of some flavonoids component. In addition, the loss in flavonoids may due to breakdown or leakage by chemical reactions includes oxygen, enzymes and light (Rababah et al., 2015).

The data analysis with Two Way Anova test show that:

a. brewing temperature significantly affects total flavonoid content,
b. simplicia (fresh and dried) preparation significantly affects total flavonoid content, and
c. the interactions of both (the brewing temperature and simplicia preparation) significantly affects total flavonoid content.

4. CONCLUSION

The total flavonoid contents of fresh fig leaf brew with the brewing temperatures of 60°C, 70°C, and 80°C are 0.0031±0.00039%, 0.0081±0.00021%, and 0.0092±0.00024%. The total flavonoid contents of dried fig leaf brew with the brewing temperatures of 60°C, 70°C, and 80°C are 0.0010±0.00025%, 0.0015±0.00004%, and 0.0017±0.00018%. Based on the results obtained, it can be concluded that increasing the brewing temperature from 60°C to 80°C increases the total flavonoid content of fig leaf brew, both fresh and dried. Total phenolic content of fresh fig leaf brew is higher than dried fig leaf brew, because the drying process decreases the availability of flavonoids. Brewing temperature, simplicia (fresh and dried) preparation, and the interactions of both (the brewing temperature and simplicia preparation) significantly affects total flavonoid content. For further research, it is necessary to increase the brewing temperature to find out the temperature when total flavonoid content decrease.

5. ACNOWLEDGMENTS

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