Total Phenolic and Organoleptic Profiles of Kahwa Daun Beverages (A Traditional Beverage in West Sumatera, Indonesia) Using Steeping Methods

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Abstract. This research determines the total phenolic content (TPC) and organoleptic profiles of *kahwa daun* beverages, a traditional beverage of West Sumatera, made using different steeping methods. The TPC was determined by using spectrophotometry UV-visible. Beverages were made of 1 g *kahwa daun* (herbal tea) in 100 ml of water with three steeping methods: brewing (pouring herbal tea with hot water and leaving them for five minutes), hot macerating (adding herbal tea to boiling water and leaving them for five minutes), and boiling (boiling herbal tea and leaving it for five minutes). The TPC of *kahwa daun* beverages was 14.16-32.08 mg/g and was calculated as gallic acid equivalent. The lowest TPC was shown by the brewing method, and the highest one was shown by the boiling method. This study has found a significant difference between brewing and the other methods ($P < 0.05$), but no significant difference between the hot maceration and boiling method. *Kahwa daun* beverages are traditionally made by boiling method, but, this study recommends that the beverages are made by the hot maceration method because it has a similar TPC. An organoleptic profile was done using the hedonic test by 30 panelists. The highest score of taste is shown in the sample made by boiling. Meanwhile, the sample made by the hot maceration method has the highest scores of colors, aroma, and appearance. Statistically, *kahwa daun* beverages made with the three methods do not have significantly different tastes and aromas. In contrast, tea and *kahwa daun* beverages have significantly different colors, aromas, tastes, and appearances.

Keywords: total phenolic content; organoleptic, *kahwa*; steeping; beverages

1 Introduction

Dried coffee leaves in West Sumatera Indonesia are called *kahwa daun* or herbal tea. *Kahwa daun* was made using three drying processing techniques [1]. The word *kahwa* is derived from an Arabic word that means coffee. Local people of Sumatera call the beverage made of *kahwa daun* as *aia kawa*, which resembles tea and is consumed as a beverage during break time. Traditionally, it is served using a container made of a coconut shell. *Kahwa daun* beverage is well known as a healthy drink and a cultural product that has not been produced for quite a long time and is only consumed for domestic purposes. In 2001, *kahwa daun* beverage was produced on a big scale for the first time. Then, it was marketed and accepted by the local people. Stalls of *kahwa daun* beverage have sprung up since 2002. Many visitors have come to taste the beverage. The *kahwa daun* beverage is made by extracting the *kahwa daun* in three ways [1][2].

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Different steeping methods would produce different coffee drinks, such as espresso, concentrate, decaf, etc.

Coffee leaves contain many compounds, such as mangiferin, chlorogenic acid, hydrocinnamic acid, trigonelline, rutin, and caffeine [3][4][5][6][7]. Researchers [4] have reported the effects of some processing methods on the phytochemical profiles of coffee leaves. However, to date, no study has reported the effects of the steeping method on the total phenolic content of *kahwa daun* beverage.

The organoleptic test was done by relaying human senses. People who tested the sample beverages are called panelists. They scored the samples based on their impression. The organoleptic assessments consisted of seven panelists who are experts in the organoleptic assessment, and one of them is a semi-trained panelist. They were selected from a limited circle and had been previously trained to recognize certain sensory properties. The organoleptic test preparation included preparing the panelists, samples, and laboratories/testing rooms. Sample preparation required sensory testing. Preparation and presentation of samples are critical points during the test. The temperature, size, code, and a number of samples must be prepared correctly. Meanwhile, the testing room should be an isolated space with permanent insulation or temporary insulation [8][9].

The present study aims to report the total phenolic content and organoleptic profiles of *kahwa daun* beverages using some extraction methods.

2 Methodology

Material

The *kahwa daun* sample was taken from a producer in Tabek Patah, Tanah Datar Residence, West Sumatera, Indonesia. The required chemicals were aquadest, gallic acid p.a (Merck), Folin Ciocalteu Reagent p.a (Merck), sodium carbonate p.a (Merck), and ethanol 96%. The research equipment was test tubes, glasses, analytical balance, cuvette, Spectrophotometer UV/Vis-Thermo Scientific, and a testing room for an organoleptic test.

Method

Total Phenolic Content

Sample Preparation

Kahwa daun was grounded into powder using a grinder and separated into three sizes of particles: big (less than 20 mesh), medium (20-80 mesh), and small (more than 80 mesh). Each size, 1 g, was steeping with 100 ml water. This study employed three steeping methods. The first was pouring *kahwa daun* with hot water and leaving them for five minutes (brewing). The second was adding *kahwa daun* with boiling water and leaving them for five minutes (hot maceration). The last was boiling *kahwa daun* and leaving it for five minutes (boiling). After completing these methods, the beverages were ready to analyze. Then, all of the beverages were prepared in duplicate.

Standard Preparation

The series of gallic acid calibration standards and sodium carbonate 20% (Na_2CO_3) were prepared. Gallic acid calibration standards were made by dissolving 250 mg gallic acid in 5 mL ethanol 96% and then diluted to 50 mL with aquadest (5 mg/mL). This solution was diluted with water to create standards of 0, 50, 100, 250, and 500 mg/L. Na2CO3 20% was made by dissolving 5 g anhydrous of Na2CO3 in 20 mL of aquadest. Then, the solution was let sit for 24

hours at room temperature. The solution was filtered through Whatman no. 1 filter paper and added with 25 mL of water.

TPC Analysis

The TPC of samples was analyzed using Reagent Folin Ciocalteu and measured by a spectrophotometer. Samples of 0.2 mL *kahwa daun* beverages, a gallic acid calibration standard, or blank (deionized or distilled water) were placed in tubes, added with 15.8 mL aquadest, and added with 1 mL Folin-Ciocalteau (FC) reagent. They were swirled to mix and incubated for 1-8 minutes at room temperature. Then they were added of 3 mL sodium carbonate solution and incubated for two hours at room temperature. The 2 ml samples were transferred to a 1-cm and 2-mL plastic or glass cuvette. Then, it's the samples' absorbance was measured at 765 nm in a spectrophotometer. All readings subtracted the absorbance of the blank and created a calibration curve from the standards. This curve was used to determine the corresponding gallic acid concentration of the samples. Values were reported in gallic acid equivalents (GAE) using units of mg/g [10][11].

Hedonic Test

Sample Preparation

Kahwa daun 80-mesh particle size was steeped using three methods.

a. Brewing

The beverages were made by mimicking the tea brewing. A 1000 ml water with a temperature 80-90° C was poured into 10 g of *kahwa daun* and pressed down after 5 minutes. The beverages were poured into a glass bottle. The sample code is 234.

b. Hot maceration

The second method was done by boiling 1000 ml of water. Then 10 g of *kahwa daun* was added into the water. After five minutes of boiling, the *kahwa daun* and water were pressed down and poured into a glass bottle. The sample code is 311.

c. Boiling

The third method is done by adding 10 g *kahwa daun* into 1000 ml water. Then they were heated until boiled. After 5 minutes of boiling, they were pressed down and poured into a glass bottle. The sample code is 570.

An 800 ml of beverage from each brewing method was added with 75 ml of 50% sugar solution. A tea sample was also prepared using a brewing method and used as a preference with a code of 139. All samples were ready to use in the hedonic test (Figure 1).

Figure 1. Samples of *Kahwa Daun* Beverages and Sensory Descriptive Analysis of Organoleptic Room

A descriptive analysis was carried out based on the principles of the quantitative descriptive analysis. This study involved 30 panelists from the sensory panel at Politeknik Pertanian Negeri

Payakumbuh. The panelists have experience in sensory evaluation of food. The profiling was performed in a sensory laboratory of Politeknik Pertanian Negeri Payakumbuh.

The panelists evaluated the samples of beverages aspirated into a 30 ml plastic cup. They cleaned their mouths with plain water between evaluating each sample. All samples with codes were served warmly at the temperature of 50° C. A semi-trained panelist rated the overall score of preferred aromas, tastes, colors, and appearance on a six-hedonic scale. At the end of the test, the panelists filled in a questionnaire to provide their demographic information. On average, they used approximately 15 minutes to complete the test.

Data Analysis

The data were analyzed using a one-way analysis of variance (ANOVA) with the SPSS program. Significant differences in the sample means were compared using Duncan's test. Afterward, the data were expressed as means ± SD of duplicate experiments with the P less than 0.05 ($P < 0.05$) representing a statistically significant difference.

3 Result and Discussion

Total Phenolic Content

The series of gallic acid calibration standards was prepared to determine total phenolics. Maximum absorption was obtained at a wavelength of 765 nm. The total phenolic concentration was calculated from the gallic acid (GA) calibration curve (0-500 mg/L). Meanwhile, the standard solution of GA has obtained equations of regression $y = 0.0012 x + 0.0061$ and coefficient correlation (r) of 0.998. These findings signify that the regression equation is linear. The GA calibration curve is presented in Figure 2.

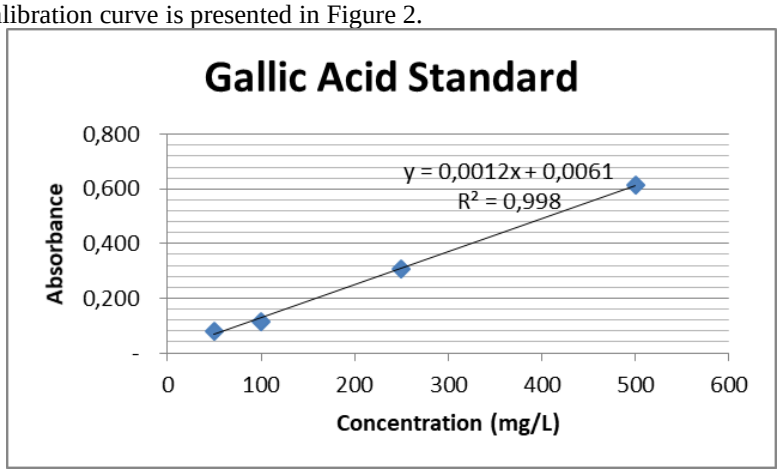

Figure 2. Gallic Acid Calibration Curve at a Wavelength of765 nm

The total phenolic content in *kahwa daun* beverages is summarized in Table 1. The highest TPC is found in the boiling method and small particle size (more than 80 mesh). The second highest TPC is found in the hot maceration method. Finally, the least TPC is found in the brewing method. Duncan's test has shown no statistically different TPC between the boiling and hot maceration methods ($P > 0.05$).

Table 1. TPC (mg GAE/g; Mean Values ± SD) in Different Steeping Methods

Treatment of steeping		Mean + SD
Brewing	20 mesh	14.16 ± 0.35[a]
Brewing	20-80 mesh	22.83 ± 2.24[b]
Brewing	80 mesh	26.12 ± 1.00[ab]
Hot Maceration	20 mesh	18.37 ± 1.94[c]
Hot Maceration	20-80 mesh	29.25 ± 1.89[de]
Hot Maceration	80 mesh	31.70 ± 1.36[d]
Boiling	20 mesh	17.25 ± 1.89[cd]
Boiling	20-80 mesh	27.87 ± 0.77[e]
Boiling	80 mesh	32.08 ± 0.24[e]

Kahwa daun beverages are traditionally made of >20 mesh particle size with a boiling method. The preparation method of *kahwa daun* beverages is unique and different from that of tea brewing. Boiling is the most popular method (91.2%) among *kahwa daun* beverage sellers [1]. There is a relationship between the particle size of *kahwa daun* and TPC in all steeping methods. A smaller particle size (large mesh numbers) gives a bigger TPC because the size of the material expands the surface of the material to extract. According to [12], the number of samples or materials that would be extracted are sizes of particle, extraction process, extraction time, and extraction temperature; these are significant factors in an extracting process. The extraction process of nature material using water could be done by decoctum, infusum, coque, brewing, and maceration methods. Herbal tea is usually made by the infusum method. Hot maceration can also be used in making steeped *kahwa daun* beverages.

Phenol compounds in coffee leaves include CQA, HCA, mangiferin, and alkaloids. In other parts of the world, coffee leaves are made with some manufacturing processes and time extractions and have a TPC of 13.4-67.6 mg gallic acid equivalent/g leaf [4]. In this research, the particle sizes of TPC of *kahwa daun* beverage in West Sumatra traditional beverages made by steeping methods are 14.16-32.08 mg of gallic acid equivalent/g of *kahwa daun*.

3.2. Organoleptic Profile

The organoleptic test of beverages was carried out using six hedonic scales. The rating scales consist of dislike (1), rather dislike (2), neutral (3), somewhat like (4), like (5), and really like (6). The organoleptic test involved 30 semi-trained panelists. A questionnaire was distributed to gain the panelists' demographic information, as summarized in Figure 3.

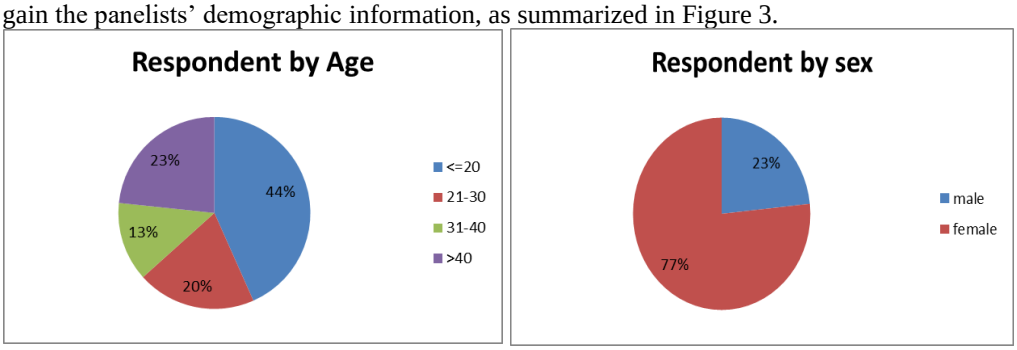

Figure 3. Age and Sex of Respondents

The panelists wrote their responses and impressions on the colors, aromas, tastes, and appearance of the beverages made in three steeping ways. These responses were stated in the provided form by giving a checkmark on the perceived impression. The beverage with the

highest average taste is found in sample 570 after tea. Meanwhile, the highest score of colors, aromas, and appearance are found in sample 311 (Figure 4). The highest mean of all parameters is found in tea, which has become a daily and well-known drink in society. Tea in the organoleptic test is highly accepted because it has been popular in the panelists' mouthfeel even though it is served in code. The results have shown that 93% of the panelists preferred tea while 40% of them prefer tea and coffee. Moreover, 73% of panelists have ever tasted *kahwa daun* beverages. For some people, *kahwa daun* beverages are new interesting products to explore. Moreover, it is a new healthy beverage because it contains high TPC.

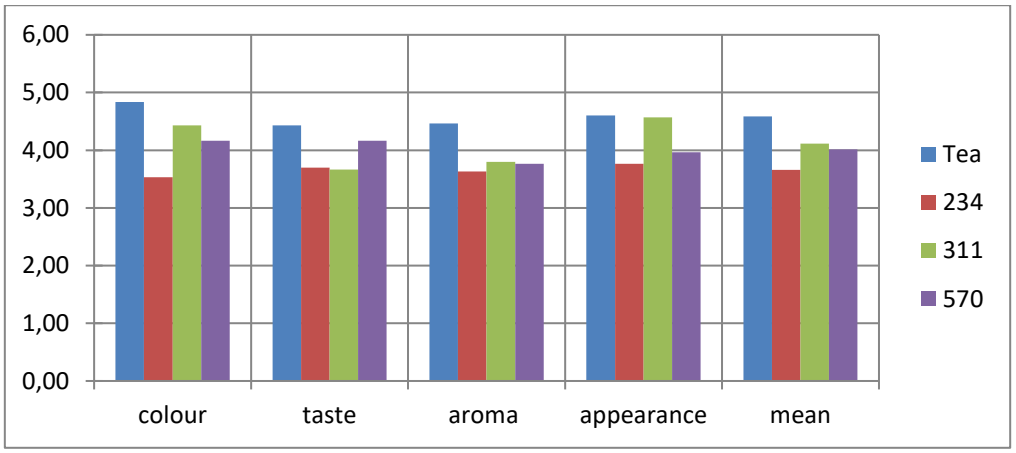

Figure 4. Organoleptic Scores of Beverages Using Three Steeping Methods

The one-way ANOVA in SPSS program was applied to analyze the panelists' responses. The results of these analyses are showed in Table 2. Statistically, *kahwa daun* beverages made using all extraction methods have no significant differences in tastes and aromas but have different colors and appearances. Colors are important and influence the acceptance of a product's visualization. Moreover, colors are the first display of foodstuffs valued by consumers [13] and sometimes give the impression of the food taste. The deviant colors from the original one can cause food not to be selected by consumers even though its condition is good [14].

It must be a concern of a sensory testing manager when choosing a panelist. For example, the panelist must be in a good condition because the sensory test involves organs that sometimes could be insensitive due to disease. Besides, the manager must build good communication with the panelists to avoid miscommunication in the implementation of the test. The panelists must be ascertained in good physical and mental health to minimize errors during the analysis. Overall, the organoleptic test shows that *kahwa daun* beverages made using multiple steeping methods are accepted with hedonic scores of 3.6-4.6 (neutral-rather like).

Table 2. Organoleptic Profiles of *Kahwa Daun* Beverages

sample	color		taste		aroma		appearance	
Tea	4.83	a	4.48	a	4.47	a	4.60	a
234	3.53	c	3.70	b	3.63	b	3.77	b
311	4.43	ab	3.67	b	3.80	b	4.57	a
570	4.17	b	4.17	ab	3.77	b	3.97	b

Note: Data in the same column but not the same letters indicate significant difference ($P < 0.05$)

4 Conclusion

Kahwa daun beverages have the highest total phenolic content in boiling and hot maceration methods. *Kahwa daun* beverages are traditionally steeped using the boiling method with a big particle size (a small mesh number). By considering TPC, it can be recommended that *kahwa daun* beverage could be made by hot maceration for five minutes with a smaller particle size. The highest score of taste is found in the boiling method, and the highest scores of color, aroma, and appearance are found in the hot maceration method.

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Author Contributions

All authors have contributed equally in conducting the research and preparing this manuscript.

References

[1] R. Novita, A. Kasim, T. Anggraini, and D. P. Putra, "Survei Proses Pembuatan Minuman Kahwa Daun di Sumatera Barat," *J. Teknol. Pertan. Andalas*, vol. 22, no. 1, pp. 32–36, 2018, doi: https://doi.org/10.25077/jtpa.22.1.32-36.2018.

[2] R. Novita, A. Kasim, T. Anggraini, and D. P. Prima, "Kahwa Daun; Traditional Knowledge Of A Coffee Leaf Herbal Tea From West Sumatera, Indonesia," *J. Ethn. Foods*, vol. 5, no. 4, pp. 286–291, 2018, doi: 10.1016/j.jef.2018.11.005.

[3] C. Campa *et al.*, "A survey of mangiferin and hydroxycinnamic acid ester accumulation in coffee (Coffea) leaves: biological implications and uses," *Ann. Bot.*, vol. 110, no. 3, pp. 595–613, Aug. 2012, doi: 10.1093/aob/mcs119.

[4] X.-M. Chen, Z. Ma, and D. D. Kitts, "Effects of processing method and age of leaves on phytochemical profiles and bioactivity of coffee leaves," *Food Chem.*, vol. 249, pp. 143–153, 2018, doi: https://doi.org/10.1016/j.foodchem.2017.12.073.

[5] P. Mazzafera, "Mineral nutrition and caffeine content in coffee leaves," *Bragantia*, vol. 58, no. 2, pp. 387–391, 1999, doi: 10.1590/S0006-87051999000200018.

[6] L. Mondolot, P. La Fisca, B. Buatois, E. Talansier, A. De Kochko, and C. Campa, "Evolution in caffeoylquinic acid content and histolocalization during Coffea canephora

leaf development," *Ann. Bot.*, vol. 98, no. 1, pp. 33–40, May 2006, doi: 10.1093/aob/mcl080.
[7] P. Talamond *et al.*, "First report on mangiferin (C-glucosyl-xanthone) isolated from leaves of a wild coffee plant, Coffea pseudozanguebariae (Rubiaceae)," *Acta Bot. Gall.*, vol. 155, no. 4, pp. 513–519, Dec. 2008, doi: 10.1080/12538078.2008.10516130.
[8] W. P. Rahayu, *Penuntun Praktikum Penilaian Organoleptik*. Bogor: Jurusan Teknologi Pangan dan Gizi Fateta, IPB, 1998.
[9] S. T. Soekarto, *Penilaian Organoleptik untuk Industri Pangan dan Hasil Pertanian*. Jakarta: Bhratara Karya Akasara, 1985.
[10] R. Andayani, Y. Lisawati, and Maimunah, "Penentuan Aktivitas Antioksidan, Kadar Fenolat Total dan Likopen Pada Buah Tomat (Solanum Lycopersicum L)," *J. Sains dan Teknol. Farm.*, vol. 13, no. 1, 2008.
[11] A. L. Waterhouse, "Determination of Total Phenolics," in *Current Protocols in Food Analytical Chemistry*, John Wiley & Sons, Inc., 2002, p. I1.1.1-I1.1.8.
[12] G. Agoes, *Teknologi Bahan Alam Seri farmasi industri*. Bandung: ITB, 2007.
[13] F. . Winarno, *Kimia Pangan dan Gizi*. Jakarta: Gramedia Pustaka Utama, 2002.
[14] M. Astawan, *Khasiat Warna-warni Makanan*. Jakarta: Gramedia Pustaka Utama, 2008.