



Comparison of Phenolic Content of Indonesian Bay Leaves (*Syzygium polyanthum*) Fresh Decoction And Herbal Tea

Irma Rahmawati*, Lilih Kaswati

Departement of Pharmacy, Akademi Farmasi Bumi Siliwangi, Jl. Rancabolang No.104, Bandung, Indonesia, 40286

Submitted 03 October 2023; Revised 23 December 2023; Accepted 23 December 2023; Published 30 December 2023

*Corresponding author: irma.rahma@akfarbumisiliwangi.ac.id

Abstract

The Indonesian bay leaves (*Syzygium polyanthum*) are one of the traditional cooking spices used in several countries in Southeast Asia, and this spice gives a distinctive herbaceous aroma. Bay leaves are often used as a medicinal plant for generations by the community to reduce cholesterol, diabetes, hypertension, gastritis, and diarrhea. The purpose of this study was to compare the content of polyphenols in Indonesian bay leaf fresh decoction and herbal tea. The total phenolic content was determined by Folin-Ciocalteu's method. The test results showed that the highest polyphenol content was found in bay leaf tea at 19.19 ± 4.06 mg/kg, and then bay leaf decoction at 6.36 ± 3.23 mg/kg. Based on the statistical analysis, it was stated that there was a difference in the levels of polyphenols in each sample, meaning that there was a significant difference. The implications of this study can be to develop processing techniques for Indonesian bay leaf which contain the best polyphenols for public consumption.

Keywords: Bay leaf decoction, bay leaf herbal tea, Folin-Ciocalteu's method, phenolic content.

Perbandingan Kandungan Polifenol pada Rebusan Daun Salam Segar (*Syzygium polyanthum*) dan Teh Herbal Daun Salam

Abstrak

Daun salam (*Syzygium polyanthum*) merupakan salah satu bumbu masakan tradisional yang digunakan di beberapa negara di Asia Tenggara, rempah ini memberikan aroma herbal yang khas terhadap masakan. Daun salam sering digunakan sebagai tanaman obat secara turun temurun oleh masyarakat Indonesia untuk menurunkan kolesterol, diabetes, hipertensi, maag, dan diare. Tujuan dari penelitian ini adalah untuk membandingkan kandungan polifenol pada rebusan dan teh daun salam. Kandungan total fenolik ditentukan dengan metode Folin-Ciocalteu. Hasil pengujian menunjukkan kandungan polifenol tertinggi terdapat pada teh daun salam sebesar $19,19 \pm 4,06$ mg/kg, kemudian rebusan daun salam sebesar $6,36 \pm 3,23$ mg/kg. Hasil analisis statistik menunjukkan bahwa terdapat perbedaan kadar polifenol pada setiap sampel, artinya terdapat perbedaan yang signifikan antara kandungan fenol pada rebusan daun salam dan teh daun salam. Implikasi dari penelitian ini dapat mengembangkan teknik pengolahan dan penyajian daun salam yang mengandung polifenol terbaik untuk dikonsumsi masyarakat.

Kata Kunci: Rebusan daun salam, teh daun salam, metode Folin-Ciocalteu, kandungan polifenol.

1. Introduction

The global pandemic of the Covid-19 virus has made people around the world aware of the importance of maintaining health. Various efforts have been made to prevent transmission of the Covid-19 virus, one of which is by increasing the body endurance¹. Chemical compounds that have great potential as antivirals and have many health benefits are polyphenols².

Polyphenol compounds are rich in extraordinary medicinal properties such as curing microbial infections, oxidative stress, inflammation, diabetes, cancer, neurodegenerative disorders, and cardiovascular disorders³. Phenolic compounds provide anti-inflammatory, anticancer, anti-aging, antibacterial, and antiviral effects⁴. Polyphenols are active substances against various types of viral infections such as influenza, herpes, hepatitis, rotavirus, corona virus, among others⁵.

Potential sources of phenolic acids and polyphenols are fruits, vegetables, herbs and spices⁶. One of the plants that are widely used by Indonesian people has many health benefits and contains polyphenols is Indonesian bay leaves. The Indonesian Bay leaf (*Syzygium polyanthum*), also known as "salam", is a type of Indonesian plant that belongs to the Myrtaceae family⁷. The Indonesian bay leaves are known to the public as a culinary ingredient that gives a distinctive aroma and slightly astringent taste for food⁸.

The main compounds contained in Indonesian bay leaves are natural polyphenol compounds. Phenolic compounds are components that contribute to the bitter taste, astringency, and pigmentation of most plants⁹, including Indonesian bay leaves.

The Indonesian bay leaves contain many antioxidants and antidiabetics compounds that can provide many health benefits, such as reduced liver function problems, reduce symptoms of nausea, vomiting, and discomfort, and increase compliance and effectiveness of tuberculosis treatment^{10,11}. Apart from that, Indonesian bay leaves can also reduce uric acid levels and gout arthritis pain intensity¹², treat hypertension^{13,14}, and reduce

cholesterol levels in the blood¹⁵. Previous research reported that Indonesian bay leaves contain several bioactive compounds, such as alkaloids, flavonoids, saponins, tannins, quinones, terpenoids⁸, and essential oils¹⁵.

In this research, Indonesian bay leaves will be processed by brewing them into herbal tea as an alternative to the simple Indonesian bay leaf brewing technique, namely decoction which only involves brewing Indonesian bay leaves with hot water. This research aimed to determine the effect of the method of brewing bay leaves in fresh form and herbal tea on the polyphenol content, so that we can find out which brewing technique provides the best benefits for health

2. Method

2.1. Materials

The Indonesian bay leaves are obtained directly from local plantations, in East Bandung, West Java, Indonesia, with the green bay leaf without any yellow spots, white spots, and holes. The materials used in this study included methanol (Merck), ferric (III) chloride (Merck), Folin-Ciocalteu phenol reagent (FCR) (Merck), sodium carbonate (Merck), and gallic acid (Merck).

2.2. Instrumentation

The instrumentation used in this research is UV-Vis spectrophotometry (Shimadzu UV1780).

2.3. Preparation of Indonesian Bay Leaf Decoction and Herbal Tea

Indonesian Bay Leaf was determined in the Plant Taxonomy Laboratory, Department of Biology, Universitas Padjadjaran, Indonesia. In the decoction preparation, 1 g of fresh Indonesian bay leaves is cut or sliced into small pieces. Then boil the Indonesian bay leaves in 1 L of boiling water (100°C) for 30 minutes, and filter so that residue and filtrate⁷. In preparation of Indonesian bay leaf herbal tea, 1 g of dried Indonesian bay leaves were steeped in 1 L of boiling water for 5 minutes and filtered¹¹.

2.4. Qualitative Analysis of Phenolic Content

The determination of phenolic compounds was tested by the ferric chloride method, by taking 1 ml of sample and adding about three drops of 1% ferric chloride reagent. The formation of a blue or green color indicates the presence of phenolic compounds¹⁶.

2.5. Determination of Total Phenolic Content

Determination of the maximum absorption wavelength and calibration curve of gallic acid must be carried out first. The maximum wavelength of gallic acid was carried out by measuring a 100 ppm concentration of gallic acid solution in the range 400-900 nm and determining the maximum wavelength value with the highest absorbance value. Standard solutions of gallic acid were prepared with concentrations of 10, 20, 30, 40, and 50 ppm. Then add 0.5 ml of Folin Ciocalteu reagent, shake, and leave for 4-8 minutes. Add 4 ml of 7% Na_2CO_3 solution and shake until homogeneous. Leave it for 60 minutes and measure the absorbance at the maximum wavelength. A calibration curve for the relationship between gallic acid concentrations was created¹⁷.

The total phenolic content in the Indonesian bay leaf decoction and herbal tea was determined using UV-Vis spectrophotometry with the Folin-Ciocalteu method. This method occurs by taking 0.5 ml of the sample solution, then adding 0.5 ml of Folin Ciocalteu's reagent and leaving it for 5 minutes, and 4 ml of Na_2CO_3 7% w/v to each solution until homogeneous, allowed to stand for 60 minutes. The absorbance of the mixture was measured at 598 nm maximum wavelength of the standard solution of gallic

acid and repeated three repetitions¹⁸.

All measurements and analyses were carried out in triplicates. Analysis of variance was performed by using oneway ANOVA. The results with $p < 0.05$ were regarded to be statistically significant.

3. Results and Discussion

3.1. Qualitative Analysis of Phenolic Content

The results from the decoction and herbal tea of Indonesian bay leaf (*Syzygium polyanthum*) were made at the same concentration of 100 ppm for each sample. The result of decocting bay leaves is brownish yellow, and the color of brewing bay leaf herbal tea is brownish yellow, a darker color than the color of decocting fresh bay leaves.

Qualitative analysis of polyphenols from Indonesian bay leaf decoction and herbal tea using the ferric chloride method which aims to determine and confirm the presence of polyphenolic compounds in the samples analyzed. The results of the phytochemical analysis in Table 1 show that the Indonesian bay leaf decoction and herbal tea contain polyphenolic compounds, these results are consistent with several previous studies^{8,11,18-21}. The reaction of FeCl_3 with the sample causes the formation of color in this test, the role of which is the hybridized Fe^{3+} ion as shown in Figure 1²².

3.2. Determination of Total Phenolic Content

In determining the phenolic content of polyphenols from Indonesian bay leaf decoction and herbal tea, the first thing to do is to determine the maximum wavelength and the linear curve of the gallic acid solution. The maximum absorbance obtained at a wavelength of 598 nm with an absorbance

Table 1. Analysis of phenolic content on Indonesian bay leaf decoction and herbal tea

Sample*	Qualitative analysis of phenolic compound**	Folin-Ciocalteu's method	
	Ferric chloride test	Absorbance	Phenolic content (mg/kg)
IBL Decoction	+	0.888	6.36 ± 3.23
IBL Herbal tea	+	1.222	19.19 ± 4.06

*IBL for Indonesian bay leaf; **(+) for positive green color formation

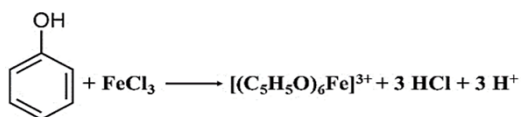


Figure 1. Phenol and ferric chloride reaction:

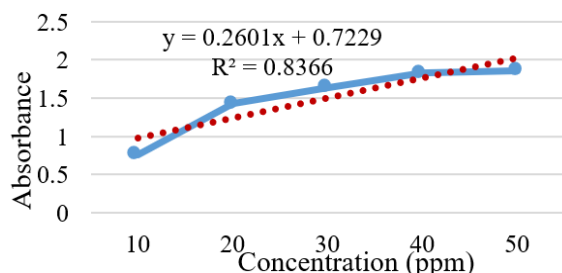


Figure 2. Linear regression of the gallic acid curve.

of 0.002 and the measurement results of the standard solution obtained a calibration curve with a linear equation for gallic acid is $y=0.02601x+0.7229$ with $R^2= 0.8366$, which shows a good correlation coefficient (Figure 2). The R^2 value is said to be good if it is >0.5 because the R^2 value ranges from 0 to 1, provided that the closer it is to 1, the better the model²³. Furthermore, the absorbance measurement of the Indonesian bay leaf decoction and herbal tea at a maximum wavelength of 598 nm using a UV-Vis spectrophotometer was carried out three times for the determination of the levels of polyphenols in each sample.

Table 1 showed that the polyphenol content in the sample obtained the highest polyphenol content in the Indonesian bay leaf herbal tea with an average GAE value of 19.19 ± 4.06 mg/kg. Then followed by a solution of Indonesian bay leaf decoction with an average GAE value of 6.36 ± 3.23 mg/kg.

This is caused by the difference in temperature treatment and soaking time between the Indonesian bay leaf decoction samples and herbal tea. The results showed that at the same brewing temperature (100°C) but with a shorter brewing time (5 minutes) the functional properties could be increased, with the highest polyphenol content in bay leaf herbal tea. In the previous research, optimum conditions for extracting Indonesian bay leaves in varied with the shortest time and lowest temperature²⁴.

This can happen because phenolic compounds are also very sensitive to high

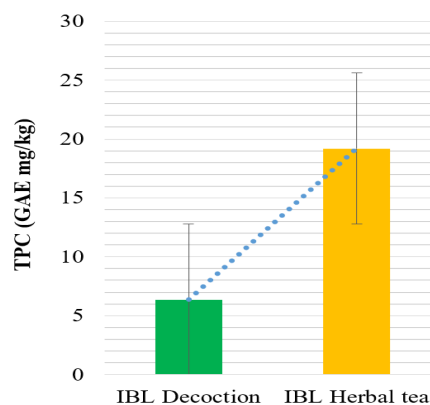


Figure 3. Comparison phenolic content on Indonesian bay leaf decoction and herbal tea, with $p < 0.05$

temperatures or the presence of oxygen¹¹. So that a longer brewing time can damage the bioactive content in bay leaves. Long brewing times result in longer exposure to heat, light and oxygen of the bioactive content in the ingredients, resulting in greater degradation of these compounds compared to shorter brewing times at higher temperatures²⁵.

The phenolic content can also be seen from the type of Indonesian bay leaf sample used. In the decoction method, the Indonesian bay leaves used are fresh, while in herbal tea, dried bay leaves are used. The high content of phenolic compounds in dry leaf extracts is caused by the drying process of dry leaves which can open the cell walls of the extracted sample so that more phenol content is extracted in the sample²⁶.

Apart from affecting the polyphenol content, long infusion times will destroy antioxidant compounds, causing a decrease in antioxidant value²⁷. In addition, heating for too long and using quite high temperatures can reduce antioxidant activity²⁸.

Polyphenols found in food and medicine have been shown to protect us from viral infections. If an infection occurs, polyphenols will support the healing process through various mechanisms, namely blocking the entry of host cells, inhibiting the multiplication of viruses, closing blood vessels, and protecting against superinfection⁵.

3.3. Comparison of Phenolic Content

The result of Indonesian bay leaf decoction and herbal tea, was performed by

using oneway Anova. The results with $p < 0.05$ were regarded to be statistically significant differences (Figure 3). The rich content of phenolic compounds makes Indonesian bay leaf have many health benefits as a medicine for various diseases²⁸. The phenolic compounds in Indonesian bay leaf leaves have antioxidant activity which can ward off free radicals. Therefore, the higher the phenol content in the extract, the higher the contribution of the extract's antioxidant activity¹⁸. Numerous studies have shown that plant extracts are the main source of compounds that exhibit strong antioxidant activity and can be used in curing many diseases related to oxidative stress such as cancer, diabetes, and cardiovascular disease²⁹.

4. Conclusion

In conclusion, the polyphenol content was higher in Indonesian bay leaf (*Syzygium polyanthum*) herbal tea. This can be a consideration in the processing of Indonesian bay leaf herbal tea that will be consumed by the community. However, the high phenolic content in Indonesian bay leaf can provide great health benefits.

References

1. Rahmawati I, Dewi Anggraeni S, Ika Julianti A. Moringa Leaf Infusion And Tea: How Are Their Antioxidant Activities Different? Journal of Islamic Science and Technology; 8. Epub ahead of print 2022. DOI: 10.22373/ekw.v8i1.11223.
2. Loaiza-Cano V, Monsalve-Escudero LM, Filho C da SMB, et al. Antiviral role of phenolic compounds against dengue virus: A review. Biomolecules 2021; 11: 1–28.
3. Singh N, Yadav SS. A review on health benefits of phenolics derived from dietary spices. Curr Res Food Sci 2022; 5: 1508–1523.
4. Rahman MM, Rahaman MS, Islam MR, et al. Role of phenolic compounds in human disease: Current knowledge and future prospects. Molecules; 27. Epub ahead of print 1 January 2022. DOI: 10.3390/molecules27010233.
5. Chojnacka K, Skrzypczak D, Izydorczyk G, et al. Antiviral properties of polyphenols from plants. Foods; 10. Epub ahead of print 1 October 2021. DOI: 10.3390/foods10102277.
6. Montenegro-Landívar MF, Tapia-Quirós P, Vecino X, et al. Polyphenols and their potential role to fight viral diseases: An overview. Science of the Total Environment; 801. Epub ahead of print 20 December 2021. DOI: 10.1016/j.scitotenv.2021.149719.
7. Dewijanti ID, Mangunwardoyo W, Dwiranti A, et al. Short communication: Effects of the various source areas of Indonesian bay leaves (*Syzygium polyanthum*) on chemical content and antidiabetic activity. Biodiversitas 2020; 21: 1190–1195.
8. Dewijanti ID, Mangunwardoyo W, Artanti N, et al. Bioactivities of Salam leaf (*Syzygium polyanthum* (Wight) Walp). In: AIP Conference Proceedings. American Institute of Physics Inc., 2019. Epub ahead of print 4 November 2019. DOI: 10.1063/1.5132499.
9. Matsumura Y, Kitabatake M, Kayano S, et al. Dietary Phenolic Compounds: Their Health Benefits and Association with the Gut Microbiota. Antioxidants; 12. Epub ahead of print 1 April 2023. DOI: 10.3390/antiox12040880.
10. Suwito BE, Shanty LM, Gumilang R, et al. Effect of Bay Leaf (*Syzygium polyanthum*) Extract on Antioxidant Activity, MDA Levels, and Liver Histopathology Feature of Ethambutol Induced Wistar Rats. Indonesian Journal of Medical Laboratory Science and Technology 2022; 4: 148–156.
11. Halim Y, Maryani. Functional and sensory properties of Indonesian bay leaf (*Syzygium polyanthum*) herbal tea. Food Res 2022; 6: 25–33.
12. Cumayunaro A. Rebusan Daun Salam Untuk Penurunan Kadar Asam Urat Dan Intensitas Nyeri Arthritis Gout Di Puskesmas Andalas Padang. Menara Ilmu; 11. Epub ahead of print 2017. DOI: <https://doi.org/10.33559/mi.v11i75.141>.

13. Nugroho A, Fadlilah S, Sucipto A, et al. Bay Leaves (*Syzygium polyanthum*) and Rosella Flowers (*Hibiscus sabdariffa*) are Effective In Reducing Blood Pressure. *Jurnal Aisyah : Jurnal Ilmu Kesehatan* 2022; 7: 395–404.
14. Darni J. Identification Of Flavonoids and Tannins In Salam Leaf Tea and Corn Hair (Saraja) Potentially As Antihypertensives. *Jurnal Gizi Dan Kesehatan* 2022; 14: 1–6.
15. Hartanti L, Yonas SMK, Mustamu JJ, et al. Influence of extraction methods of bay leaves (*Syzygium polyanthum*) on antioxidant and HMG-CoA Reductase inhibitory activity. *Heliyon* 2019; 5: 1485.
16. Fachriyah E, Kusriani D, Haryanto IB, et al. Phytochemical Test, Determination of Total Phenol, Total Flavonoids and Antioxidant Activity of Ethanol Extract of Moringa Leaves (*Moringa oleifera* Lam). *Jurnal Kimia Sains dan Aplikasi* 2020; 23: 290–294.
17. Molole GJ, Gure A, Abdissa N. Determination of total phenolic content and antioxidant activity of *Commiphora mollis* (Oliv.) Engl. resin. *BMC Chem*; 16. Epub ahead of print 1 December 2022. DOI: 10.1186/s13065-022-00841-x.
18. Luliana S, Riza H, Indriyani EN. The Effect of Extraction Method on Total Phenolic Content and Antioxidant Activity of Salam Leaves (*Syzygium polyanthum*) using DPPH (1,1-Diphenyl-2-Picrylhydrazil). *Traditional Medicine Journal* 2019; 24: 72–76.
19. Yuningtyas S, Masaenah E, Telaumbanua M. Aktivitas Antioksidan, Total Fenol, Dan Kadar Vitamin C Dari Kombucha Daun Salam (*Syzygium polyanthum* (Wight) Walp.). *Jurnal Farmamedika* 2021; 6: 10–14.
20. Fajriah F, Faridah DN, Herawati D. Penurunan Indeks Glikemik Nasi Putih dengan Penambahan Ekstrak Serai dan Daun Salam. *Jurnal Teknologi dan Industri Pangan* 2022; 33: 169–177.
21. Rahmatia L, Nasrudin, Nurlansi. Fitokimia dan Aktivitas Antiradikal DPPH Seduhan Daun Salam (*Syzygium polyanthum* Wight.). *Sains: Jurnal Ilmu Kimia dan Pendidikan Kimia* 2022; 11: 52–61.
22. Manongko PS, Sangi MS, Momuat LI. Uji Senyawa Fitokimia dan Aktivitas Antioksidan Tanaman Patah Tulang (*Euphorbia tirucalli* L.). *Jurnal MIPA* 2020; 9: 64–69.
23. Rhamadhani DA, Saputri EED. Analisa Model Machine Learning dalam Memprediksi Laju Produksi Sumur Migas 15/9-F-14H. *Journal Of Sustainable Energy Development* 2023; 1: 48–55.
24. Masaki G, Santoso F, Puteri MDPTG. Optimization of Aqueous Extraction of Indonesian Bay Leaf (*Syzygium polyanthum* Wight) as Powder Seasoning. *Adv Biol Sci Res* 2022; 16: 381–384.
25. Nguyen QV, Chuyen H Van. Processing of herbal tea from roselle (*Hibiscus sabdariffa* L.): Effects of drying temperature and brewing conditions on total soluble solid, phenolic content, antioxidant capacity and sensory quality. *Beverages* 2020; 6: 1–11.
26. Rahmah MH, Nurfilia N, Sari AP. Total Phenol and Total Flavonoid of Graded Fractionation Fresh and Dried *Muntingia calabura* Extract: A Sustainable Immunomodulator Bioagent for Functional Health Drink. *Jurnal Pembelajaran Dan Biologi Nukleus* 2022; 8: 767–780.
27. Husni A, Putra DR, Lelana IYB. Antioxidant Activity of *Padina* sp. at Various Temperature and Drying Time. *JPB Perikanan* 2014; 9: 165–173.
28. Rahmawati I, Anggraeni SD, Bernika SO, et al. Phenolic content and antioxidant activity of *Moringa oleifera* leaf infusions and tea. In: *AIP Conference Proceedings*. American Institute of Physics Inc., 2023. Epub ahead of print 13 March 2023. DOI: 10.1063/5.0118400.
29. Taroq A, El Kamari F, Aouam I, et al. Antioxidant Activities And Total Phenolic And Flavonoid Content Variations Of Leaf Extracts Of *Laurus Nobilis* L. From Morocco. *Asian Journal of Pharmaceutical and Clinical Research* 2018; 11: 540–543.