



(RESEARCH ARTICLE)



The effect of addition of mint leaves (*Mentha piperita. L*) on the characteristics of coffee leaf herbal tea

Rina Yenrina ^{1,*}, Novelina ¹, Hayatul Fitri ² and Jihan Rahma ²

¹ Lecturers at Faculty of Agricultural Technology, Andalas University, Limau Manis-Padang, Indonesia.

² Alumni of Food Technology and Agricultural Product, Andalas University, Limau Manis-Padang, Indonesia.

World Journal of Advanced Engineering Technology and Sciences, 2024, 12(02), 684–690

Publication history: Received on 01 July 2024, revised on 07 August 2024, and accepted on 10 August 2024

Article DOI: <https://doi.org/10.30574/wjaets.2024.12.2.0340>

Abstract

This research aimed to determine the characteristics of herbal tea bags added with mint leaf and coffee leaf and to find out which herbal tea bag formulations with mint leaf and coffee leaf have the best characteristics. The design used in this study was a completely randomized design (CRD) with 5 treatments and 3 replications. The treatments in this study were A (without the addition of mint leaf), B (addition of 1% of mint leaf), C (addition of 2% of mint leaf), D (addition of 3% of mint leaf) and E (addition of 4% of mint leaf). The research data were statistically analyzed using ANOVA and continued with Duncan's New Analysis Multiple Range Test (DNMRT) at the 5%. The result showed the ratio of herbal tea bags added with mint leaf and coffee leaf had significant different effects total polyphenols, antioxidant activity, caffeine content and, total water soluble matter. The best treatment based on physical, and chemical analysis of herbal tea bags added with mint leaf and coffee leaf was treatment E with the addition of 4% mint leaf as the best product with the result of chemical analysis water content 5.44% antioxidant activity 73.1%, total polyphenols 146.54 mg GAE/g, caffeine content 0.33%, and total water soluble ingredients 24.00%.

Keyword: Mint leaf; Coffe leaf; Characteristic; Antioxidant

1. Introduction

Tea is a drink that is widely consumed because it is believed to have many benefits. Tea is divided into two types, namely *Camelia sinensis* tea and herbal tea. Herbal tea is a mixture of herbs derived from various parts of plants such as flowers, leaves, seeds, roots or fruit skin [1]. Herbal tea has many health benefits because the ingredients contained in medicinal plants are easily dissolved in hot water when brewed [2]. One plant that can be used as herbal tea is coffee leaves which are processed into herbal tea. Coffee leaf herbal tea or kahwa leaf is a term that has become attached to the Minangkabau people, namely a drink made from coffee leaves. Coffee leaves contain flavonoids, alkaloids, saponins, caffeine, antioxidants and polyphenols [3].

Coffee leaf herbal tea produces a brownish drink like the result of steeping *Camellia sinensis* tea leaves. When drinking coffee leaf herbal tea, an astringent and bitter taste appears with a light aroma and clearer color than brewing coffee beans [4]. To reduce the astringent and bitter taste of coffee leaf herbal tea and to make variations of coffee leaf herbal tea, other ingredients are added, one of which is the addition of mint leaves.

The mint plant is a plant originating from sub-tropical areas and is known by its Latin name, namely *Mentha piperita L*, belonging to the Lamiaceae family. Mint plants produce essential oils with menthol compounds whose properties are used as aroma and flavor enhancers in food, drinks, medicines, perfumes, cosmetics and other refreshing products [5].

* Corresponding author: Rina Yenrina

Based on this, research was conducted with the title "The Effect of Adding Mint Leaves (*Mentha piperita* L.) on the Characteristics of Coffee Leaf Herbal Tea"

2. Material and methods

2.1. Materials and Tools

The ingredients used in this research were aged robusta coffee leaves and fresh mint leaves. The chemicals used in this research were distilled water, methanol, Follin Ciocalteu's phenol reagent, 5% Na₂CO₃, chloroform, and DPPH reagent (2,2-Diphenyl-1-Picrylhydrazyl).

The tools used in this research are food dehydrator, spatula, 1 ml pipette, analytical balance, aluminum cup, desiccator, oven, gegap, measuring cup, test tube, vortex, aluminum foil, filter paper, beaker, dropper pipette, erlenmeyer, blender, hot plate, spectrophotometer (Shimadzu) and ultrasonic bath.

2.2. Research Design

Treatment of different concentrations of adding mint leaves to coffee leaf herbal tea consisting of 5 treatment levels and 3 repetitions. Data from observations was carried out using analysis of variance (ANOVA). If they are significantly different, they will be continued with Duncan's test.

New Multiple Range Test (DNRT) at the 5% level. The different concentration treatments for adding mint leaves to the coffee leaf herbal tea used in this research were:

- A = Without adding mint leaves
- B = Addition of 1% mint leaves
- C = Addition of 2% mint leaves
- D = Addition of 3% mint leaves
- E = Addition of 4% mint leaves

2.3. Implementation of Research

2.3.1. Making Coffee Leaf Powder

The coffee leaves are withered for 18 hours at room temperature, then the coffee leaves are turned over evenly, the size is reduced by cutting the leaves into pieces of around 1-3 cm, then dried using a food dehydrator at 60oC for 5 hours, after the coffee leaves are dry. Reduce the size using a blender for ± 3 minutes.

2.3.2. Making Mint Leaf Powder

Mint leaves are cleaned from the stems, then dried using a food dehydrator at a temperature of 60oC for ±3 minutes.

2.3.3. Making Herbal Tea Bags from a Mixture of Coffee Leaf Powder and Leaves

Coffee leaf powder is added with mint leaf powder according to the specified treatment, then packaged using a tea bag measuring 5.5 x 7.5 cm. The formulation of coffee leaf herbal tea bags with the addition of mint leaves can be seen in Table 1;

Table 1 Tea Bag Formulation

Materials	Treatment				
	A	B	C	D	E
Coffee Leaves	2	2	2	2	2
Mint leaves	0	0.02	0.04	0.06	0.08

Source: Modification, [6]

3. Result and discussion

3.1. Raw Material Observation

The results obtained from the analysis of each raw material can be seen in Table 2 as follows:

Table 2 Raw Material Analysis

Analysis	Coffee Leaf Values \pm SD	Mint leaves Values \pm SD
Water content (%)	6.11 \pm 0.51	5.33 \pm 0.33
Caffeine Levels (%)	0.51 \pm 0.008	-
Antioxidants (%)	67.9 \pm 0.8	47.4 \pm 2.72

Note: (-) no test was carried out

The results of the analysis of the water content of dry coffee leaves were an average of 6.11% and dry mint leaves were an average of 5.33%. According to [7], the quality requirement for dry tea water content is 8%. Dried coffee leaves and dried mint leaves have met the existing water content standards. From the results of the analysis of the antioxidant activity of the raw materials, dried coffee leaves and mint leaves are 67.9% and 47.4%, respectively. The average antioxidant activity results in coffee leaves were 67.9%, which is not much different from previous research conducted by [8]. The antioxidant activity of kahwa coffee leaves was found on average at 66.92%.

The results of the caffeine content analysis were 0.51%. According to [9] the maximum limit for caffeine in food and drinks is 150 mg/day and 50 mg/serving.

3.2. Chemical Analysis

3.2.1. Water Content

Water content will affect the quality of tea, especially shelf life, where water content that is too high will cause the product to become damp and quickly spoil, allowing microbes to grow and develop [10]. The results of the water content analysis are presented in Table 3 as follows:

Table 3 Water Content Analysis

Treatment	(Water Content Analysis) Mean \pm SD
A (0%)	6.11 \pm 1.1
B (1%)	6.00 \pm 0.7
C (2%)	5.89 \pm 0.5
D (3%)	5.67 \pm 0.9
E (4%)	5.44 \pm 0.2
KK=12.54%	

Based on the data in Table 3, it can be seen that the amount of mint leaves added to coffee leaf herbal tea does not have a significantly different effect on water content. The average water content of coffee leaf herbal tea with the addition of mint leaves ranges from 5.44% to 6.11%. The treatment with the addition of mint leaves gave the highest water content results in treatment A (adding 0% mint leaves), namely 6.11% and the lowest water content was obtained by treatment E (adding 4% mint leaves), namely 5.44%. The results from Table 3 show that the more mint leaves added to the coffee leaf herbal tea, the lower the water content produced. This is caused by evaporation of the mint leaves during the water content process. According to [11] mint leaf extract is classified as an essential oil which contains volatile compounds and is easy to evaporate. Apart from that, the low water content of tea is caused by the heating process carried out.

When compared with [7] concerning the quality of dry tea, the water content of coffee leaf herbal tea with the addition of mint leaves meets the standard, namely below 8%.

3.2.2. Total Polyphenols

Total phenol is a phenolic compound which plays a role in preventing oxidation events. The total phenol test aims to determine the total amount of phenolic compounds contained in the sample because most of the antioxidants in the internal ingredients are polyphenolic compounds so that if the phenolic compound content in the sample is high then the antioxidant activity will also be high [12]. The results of the total polyphenol analysis can be seen in Table 4 below:

Table 4 Average Total Polyphenol Value of Coffee Leaf Herbal Tea with the Addition of Mint Leaves

Treatment (Addition of Mint Leaves)	Total Polyphenols (mg GAE/g) ± SD
A (0%)	132.89 ± 4.25 a
B (1%)	136.77 ± 6.03 a b
C (2%)	138.49 ± 1.14 a b c
D (3%)	142.80 ± 4.37 b c
E (4%)	146.54 ± 4.00 c
KK= 9,67%	

Note: Numbers followed by different lowercase letters are significantly different at the 5% level according to DMNRT

Based on the data in Table 4, it can be seen that the total polyphenols in coffee leaf herbal tea with the addition of mint leaves are on average in the range of 132.89 mg GAE/g-146.54 mg GAE/g. The highest total polyphenols were obtained in treatment E (addition of 4% mint leaves) with an average value of 146.54 mg GAE/g and the lowest in treatment A (addition of 0% mint leaves) with an average value of 132.89 mg GAE/g. It can be concluded that the addition of more mint leaves to coffee leaf herbal tea causes an increase in the total polyphenols obtained. The total influence of polyphenols in tea can come from the active substances contained in each ingredient. The analysis results showed that the more mint leaves used in tea, the total polyphenol content increased. This increasing trend in total polyphenols is thought to be because the total polyphenol content in coffee leaves is lower than in mint leaves. The total polyphenols of mint leaves range between 130 µg/mg–450 µg/mg depending on the variety [13].

3.2.3. Antioxidant Activity

The antioxidant activity of coffee leaves mainly comes from phenolic acids which function as an antidote to free radicals [8]. Based on analysis of variance, the results obtained for antioxidant activity at the 5% level show that the addition of mint leaves to coffee leaf herbal tea has a significant effect on antioxidant activity. the resulting coffee leaf tea. The results of the antioxidant activity test can be seen in Table 5 as follows:

Table 5 Results of Antioxidant Activity Testing of Coffee Leaf Herbal Tea

Treatment	Antioxidant Activity (%) Mean ± SD
A (0%)	69.2 ± 1.5 a
B (1%)	70.5 ± 2.9 a
C (2%)	71.0 ± 2.1 a
D (3%)	72.0 ± 3.5 a
E (4%)	73.1 ± 1.7 b
KK= 12.54%	

Note: Numbers followed by different lowercase letters are significantly different at the 5% level according to DMNRT

Based on the data in Table 5 above, it can be seen that the antioxidant activity using the DPPH method in coffee leaf herbal tea with different concentrations shows an increase with each addition of mint leaves. The average antioxidant test results ranged from 69.2% - 73.1%. The treatment that had the highest antioxidant activity value was treatment E (adding 4% mint leaves) at 69.2%, while the treatment that had the lowest antioxidant activity was treatment A (adding 0% mint leaves) at 69.2%. Based on [3]'s research, tests on coffee leaf extract had antioxidants of around 55.43% - 89.78%.

The more mint leaves you add, the more antioxidant activity increases because mint leaves also contain antioxidants, so they have an effect on the coffee leaf herbal tea produced. This is because mint leaves contain the compounds limonene, cineole, menthone, menthol as well as pulegone and polyphenols (19%), carotene and tocopherol which act as antioxidants [14]. Mint leaves have very high power as a primary antioxidant that reacts with free radical compounds. Polyphenols are components that are responsible as antioxidants [13].

3.2.4. Caffeine Levels

Caffeine is a xanthine alkaloid compound in crystal form and with a bitter taste which works as a psychoactive stimulant drug and a mild diuretic [15]. The addition of mint leaves was significantly different at the 5% level on the caffeine content of the coffee leaf herbal tea and the mint leaves produced. The results of the average caffeine levels can be seen in Table 6 as follows:

Table 6 Results of Testing Caffeine Content of Coffee Leaf Herbal Tea

Treatment	Caffeine Content (%) Mean ± SD
A (0%)	0.51 ± 0.007 a
B (1%)	0.46 ± 0.010 b
C (2%)	0.39 ± 0.010 c
D (3%)	0.36 ± 0.005 d
E (4%)	0.33 ± 0.005 e
KK= 6.08%	

Note: Numbers followed by different lowercase letters are significantly different at the 5% level according to DMNRT

In Table 6 above, you can see that the average caffeine content value for coffee leaf herbal tea ranges from 0.33% - 0.51%. The highest caffeine content was obtained in treatment A (0% addition of mint leaves) with a value of 0.51%. The lowest caffeine content was obtained in treatment E (4% addition of mint leaves) with a value of 0.33%. The more mint leaves were added, the caffeine content decreased. This is because mint leaves do not contain caffeine.

3.2.5. Total Water Soluble Materials

Total water soluble materials are materials dissolved in water that are not filtered by paper, namely millipore paper with a pore size of 0.45 µm. These materials consist of organic and inorganic compounds that are soluble in water, minerals and salts found in solution [16]. The results of the analysis of total water soluble materials can be seen in Table 7 as follows:

In Table 7 it can be seen that the addition of mint leaves has a significant effect on the total water soluble ingredients of coffee leaf herbal tea. The total amount of water soluble materials on average ranges from 18.00% - 24.00%. The highest total water soluble material obtained was in treatment E (4% addition of mint leaves), namely 24.00% and the lowest total water soluble material was in treatment A (0% addition of mint leaves), namely 18.00%. There are water-soluble compounds in mint leaves, namely saponins, compounds that cause foam when shaken in water. Saponins are divided into 2 types, namely triterpenoid saponins and steroid saponins. Both types of saponins are soluble in water and ethanol. Flavonoid compounds are polar so a polar solvent is needed. Solvents that are polar include ethanol, methanol, acetone and water [17]. However, there are several water-soluble compounds found in coffee leaves and mint leaves, including flavonoids, alkaloids, saponins, tannins and polyphenols. Flavonoids and tannins are phenols, the properties of phenolic compounds are that they dissolve easily in water, quickly form complexes with proteins and are very sensitive to enzyme oxidation [18].

Table 7 Test Results for Total Water Soluble Materials

Treatment	Total Water Soluble Materials (%) Mean \pm SD	
A (0%)	18.00 \pm 1.0	a
B (1%)	19.00 \pm 1.0	a
C (2%)	21.33 \pm 0.6	b
D (3%)	23.00 \pm 2.0	b c
E (4%)	24.00 \pm 1.0	c
KK= 5.75%		

Note: Numbers followed by different lowercase letters are significantly different at the 5% level according to DMNRT

4. Conclusion

Based on the research that has been carried out, the following conclusions can be drawn:

The research results showed that the addition of mint leaves to coffee leaf herbal tea had a significant effect on total polyphenols, antioxidant activity, caffeine content and total water soluble ingredients. But it has no real effect on the water content test. The results obtained by treatment E with the addition of 4% mint leaves were the best product with chemical analysis parameters of water content 5.44%, antioxidant activity 73.1%, total polyphenols 146.54 mg GAE/g, caffeine content 0.33%, and total water soluble ingredients 24.00%.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

- [1] Ravikumar, C. 2014. Review on herbal teas. *Journal of Pharmaceutical Sciences and Research*, 6(5): 236.
- [2] Wahyuningsih, M.S. 2011. *Deskriptif Penelitian Dasar Herbal Medicine*. Bagian Farmasi Kedokteran, Fakultas Kedokteran UGM. Yogyakarta.
- [3] Wulandari, A. 2014. *Aktifitas Antioksidan Kombucha Daun Kopi (Coffea arabicca) dengan Variasi Lama Waktu Fermentasi dan Konsentrasi Ekstrak*. Universitas Muhammadiyah
- [4] Putra, N. 2009. Dengan Kawa Daun Payakumbuh. [Situs ternyata-air-kawa-bermanfaat-bagi-.html](#). Accessed in February 2023.
- [5] Fitri, H. 2023. *Pengaruh Penambahan Daun Mint (Mentha piperita L.) Terhadap Karakteristik Teh Kahwa Daun*. Fakultas Teknologi Pertanian. Universitas Andalas. Padang
- [6] Sevoni, M. 2022. *Mempelajari Karakteristik Teh Pandan Wangi (Pandanus amaryllifolius Roxb.) dengan Penambahan Daun Mint (Mentha piperita L.)*. Fakultas Teknologi Pertanian. Universitas Andalas. Padang
- [7] [BSN]. 2013. SNI 3836:2013 Teh Kering dalam Kemasan. Badan Standarisasi Nasional, 1-11.
- [8] Khotimah, K. 2014. "Karakteristik Kimia Kopi Kawa dari Berbagai Umur Helai Daun Kopi yang di Proses dengan Metode Berbeda " *Jurnal Teknologi Pertanian* 9 (1): 40-48
- [9] [BSN]. 2006. SNI 01-7152-2006 Aditif Persyaratan Perisa Dan Penggunaan Dalam Produk Pangan
- [10] Garis, Pirdan, Romalasari, A., dan Purwasih, R. 2019. *Pemanfaatan Limbah Kulit Kopi Cascara menjadi Teh Celup*. IRWNS. Politeknik Negeri Subang. Subang
- [11] Primadiati, R. 2002. *Aromaterapi*. PT. Gramedia Pustaka Utama. Jakarta.

- [12] Hermawan, Heri, Sari,B., dan Nashrianto, H. 2018. Kadar Polifenol dan Aktivitas Antioksidan Ekstrak Etil Asetat dan Metanol Buah Ketapang (*Terminalia catappa L.*). Jurnal Ilmiah Farmasi Vol. 1 (1).
- [13] Nickavar, B, Alinaghi A dan Kamalinejad. 2008. Evaluation on the antioxidant properties of five mentha species. Iranian Journal of Pharmaceutical Research 7(3): 203-209
- [14] Alankar, S. 2009. A Review on Peppermint Oil. Asian Journal of Phamaceutical and Clinical Research Vol. 2 No. 2
- [15] Fitri, N.S. 2008. Pengaruh Berat dan Waktu Penyeduhan terhadap Kadar Kafein dari Bubuk Teh. Fakultas Matematika dan IlmuPengetahuan Alam, Universitas Sumatera Utara. Medan.
- [16] Rozi, F. 2021. Karakteristik The Celup Herbal Berbahan Baku Daun Belimbing Wuluh (*Averrhoa bilimbi*), Daun Pegagan (*Centella asiatica*) dengan Substitusi Bubuk Kayu Manis (*Cinnamomun burmannii*) sebagai Minuman Fungsional. Universitas Andalas. Padang.
- [17] Verdiana, Melia, Widarta,W R., dan Permana,M. 2018. Pengaruh Jenis Pelarut pada Ekstraksi menggunakan Gelombang Ultrasonik terhadap Aktivitas Atioksidan Ekstrak Kulit Buah Lemon (*Citrus limon* (Linn.) Burm F.). Jurnal Ilmu dan Teknologi Pangan. 7(4):213-222
- [18] Sujatmiko,Y., Adi. 2014. Aktivitas Antibakteri Ekstrak Kayu Manis (*Cinnamomum burmannii B.*) dengan Cara Ekstraksi yang Berbeda terhadap Escherichia coli Sensitif dan Multiresisten Antibiotik. Fakultas Keguruan danIlmu Pendidikan Universitas Muhammadiyah Surakarta. Surakarta.