

Comparison of antioxidant activity of fresh rose flowers (*Rosa damascena Mill*) and rose tea with different drying methods

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Abstract. Rose tea (*Rosa damascena Mill*) is a natural source of antioxidants, containing compounds such as anthocyanins, phenols, and flavonoids. The production process of rose tea involves high temperatures, which can decrease antioxidant activity. This study aims to analyze the differences in antioxidant activity between fresh rose flowers and rose tea using various drying methods, determine the higher antioxidant activity between fresh and dried rose samples, identify the treatment that results in the highest phenol content, and the treatment that yields the highest flavonoid content. The antioxidant activity was tested using the DPPH (2,2-diphenyl-1-picrylhydrazyl) method, phenol content was measured using the Folin-Ciocalteu method, and flavonoid content was determined using the aluminum chloride (AlCl₃) method. The results were analyzed using ANOVA and DMRT tests. The study found that fresh rose flowers and rose tea with different drying methods had varying antioxidant activities. The highest yield was found in oven-dried rose tea at 20.89%. Fresh rose flowers exhibited the highest antioxidant activity with an IC₅₀ value of 39.48 ± 2.9 ppm, indicating a very strong antioxidant category. The highest total phenol content was in oven-dried rose tea at 278 ± 22 mg GAE/g extract, while the highest total flavonoid content was in sun-dried rose tea at 419 ± 4 mg QE/g extract.

1 Introduction

Antioxidants are compounds that can inhibit or neutralize free radicals, which can cause cellular damage in the human body. Free radicals can lead to various degenerative diseases such as cancer, heart disease, and premature aging [1, 2]. Therefore, research on natural sources of antioxidants is becoming increasingly important. One potential source of antioxidants is the rose flower (*Rosa damascena Mill*) [3] and rose tea produced through various drying methods.

Roses are known for their beauty and fragrance and their high content of bioactive compounds, including flavonoids and phenols. Fresh rose flowers contain abundant antioxidants such as anthocyanins, which belong to the flavonoid group [4]. These

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compounds exhibit strong antioxidant activity [5]. According to [6], 10 grams of rose tea showed an antioxidant activity of 20.91%. Rose tea, made from dried rose petals, is also known for its various health benefits, including its antioxidant capability.

Different drying methods can affect the active compound content in rose tea [7], making it crucial to evaluate the most effective drying method for maintaining or enhancing antioxidant activity. Oven drying, a non-conventional drying method, facilitates temperature control, which is important as high temperatures can degrade chemical compounds in the samples [8].

This study aims to compare the antioxidant activity, phenol, and flavonoid content between fresh rose flowers and rose tea processed through various drying methods including sun drying, wind drying, and oven drying at 50°C. The research will help determine the most effective drying method for maintaining or enhancing antioxidant content in rose flowers and tea.

2 Material and Methods

This research was conducted at the Botany Laboratory and Biotechnology Laboratory of Universitas Ahmad Dahlan, Yogyakarta. The primary material used was fresh rose flowers (*Rosa damascena* Mill).

The drying methods used were sun drying, wind drying, and oven drying at 50°C. Extraction was performed using the maceration method with methanol as the solvent. The extracts were concentrated using a rotary evaporator at 50°C.

Antioxidant activity was determined using the DPPH method (50 µL/mL) with concentration series of 0, 20, 40, 60, 80, and 100 ppm. Absorbance was measured using a UV-Vis spectrophotometer at 517 nm. The percentage of inhibition was calculated using the formula (1).

$$\text{Percentage inhibition} = (1 - (A_s/A_b)) \times 100\% \quad (1)$$

Total phenol content was determined using the Folin-Ciocalteu method with gallic acid as the standard solution at 0, 10, 20, 30, 40, and 50 ppm concentrations. Absorbance was measured at 750 nm, and results were expressed in mg GAE/g extract.

Total flavonoid content was measured using the aluminum chloride method with quercetin as the standard solution at 0, 20, 40, 60, 80, and 100 ppm concentrations. Absorbance was measured at 415 nm, and results were expressed in mg QE/g extract. Data were analyzed using ANOVA and Duncan's multiple range test to determine significant treatment differences.

3 Results and Discussion

Maceration is a continuous extraction technique under cold conditions, as high temperatures can damage secondary metabolites in natural materials [9]. Phenol and flavonoid compounds targeted in this research dissolve more easily without heating [2]. Methanol was chosen as the solvent due to its universal nature, capable of binding polar, semi-polar, and non-polar compounds [4]. Methanol has been shown to yield the highest flavonoid content [5,6]. The high solubility of phenol compounds in polar solvents results in high extract concentrations [6].

Antioxidant activity was tested using the DPPH method, which is highly effective in scavenging free radicals compared to FRAP and ABTS methods [8]. Gallic acid was used as the standard for antioxidant activity due to its stability and purity [5,9]. The reaction that happened between DPPH and the antioxidant molecule is shown in Figure 1.

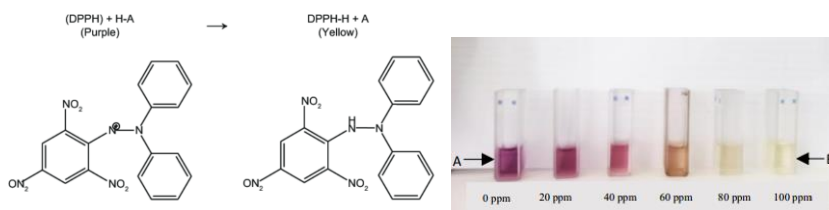


Fig. 1. Reaction that happened between DPPH and antioxidan molecule [14]

The result showed that rose has high antioxidant activity and also high phenolic content (Table 1.)

Table 1. Results of antioxidant activity, total phenol, and flavonoid content measurements.

Treatment	IC ₅₀ Value (ppm)	Total Phenol (mg GAE/ g extract)	Total Flavonoid (mg QE/ g extract)
Fresh rose flowers	39.48±2.79a	244±0.79a	4.17±0.01a
Oven-dried rose tea	44.54±0.99b	278±2.20b	4.17±0.01a
Sun-dried rose tea	49.50±3.75c	246±1.30a	4.19±0.04a
Wind-dried rose tea	54.70±0.33c	248±1.24ab	4.17±0.01a

Fresh rose flowers exhibited the highest antioxidant activity with an IC₅₀ value of 39.48 ± 2.79 ppm, categorized as very strong. High antioxidant activity in fresh rose flowers is attributed to the absence of drying processes, which can reduce antioxidant content [17]. Oven-dried rose tea also showed strong antioxidant activity with an IC₅₀ value of 44.54 ± 9.9 ppm. Oven drying optimizes bioactive compound retention compared to sun and wind drying, which can degrade phenol compounds and activate oxidative enzymes, leading to the loss of flavonoid complexes [9,11].

The highest total phenol content was in oven-dried rose tea at 278 ± 22.0 mg GAE/g extract, not significantly different from other treatments. The total phenol content in rose flowers and tea with different drying methods can be influenced by the drying method [9,10].

Fresh rose flowers, wind-dried rose tea, and oven-dried rose tea had the same total flavonoid content of 417 ± 0.01 mg QE/g extract. Sun-dried rose tea had a slightly higher total flavonoid content of 419 ± 0.04 mg QE/g extract. The total flavonoid content was not significantly affected by the drying method [13].

Antioxidant activity in roses is influenced by various bioactive compounds, including tannins, geraniol, nerol, citronellol, geranic acid, terpenes, pectin, polyphenols, vanillin, carotenoids, stearoptene, farnesol, eugenol, phenethyl alcohol, and vitamins B, C, E, and K. Anthocyanin pigments such as cyanidin glycosides, malvidin glycosides, and pelargonidin glycosides also contribute to antioxidant activity [15, 18, 20]. Drying methods significantly affect antioxidant activity, phenol, and flavonoid content [10,16]. Oven drying at 50°C provided better results compared to sun and wind drying. Antioxidant activity in fresh roses and dried rose tea with different drying methods exhibited strong to very strong free radical scavenging, with inhibition percentages ranging from 87.8% to 95.21%. High antioxidant activity in roses and rose tea makes them a potential source of natural antioxidants [19].

4 Conclusion

This research demonstrated the highest antioxidant activity in fresh rose flowers with an IC₅₀ value of 39.48 ± 2.79 ppm, categorized as very strong. The highest total phenol content

was found in oven-dried rose tea at 278 ± 22 mg GAE/g extract, while the highest total flavonoid content was in sun-dried rose tea at 419 ± 4 mg QE/g extract. Oven drying at 50°C is an effective method for producing high antioxidant activity and phenol content in rose tea, indicating its potential as a natural antioxidant source.

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Data availability statement -

Author contribution statement Konsep AP; Metodologi AP dan RN; analisis data RN; validasi AP; penulian artikel: AP dan RN.

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