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STUDY OF THE ANTIRADICAL ACTIVITY OF ASIAN MINT (MENTHA ASIATICA) PLANT

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Abstract:
Plant extract was obtained through ethanol-based ultrasonic extraction and tested at different concentrations (25, 50, 75, and 100 µL) against DPPH radicals. Spectrophotometric measurements were performed at 517 nm to assess the degree of radical neutralization. The results demonstrated that the Mentha asiatica extract possesses significant antiradical potential, with an IC_{50} value of 93.41 µL, indicating moderate antioxidant activity. These findings confirm the presence of bioactive compounds, particularly natural polyphenols and flavonoids, contributing to the plant's radical scavenging efficiency. The study provides scientific evidence supporting the traditional use of Mentha asiatica as a natural remedy and highlights its potential for development into pharmaceutical or nutraceutical antioxidant products.

Keywords: Mentha asiatica, Asian mint, antiradical activity, DPPH assay, IC_{50}, spectrophotometry, ethanol extraction, free radicals, polyphenols, natural antioxidants, bioactive compounds.

Introduction

Mentha asiatica, commonly referred to as Asian mint, is a medicinal plant belonging to the Lamiaceae family and is widely distributed across Central and South Asian countries, including Uzbekistan. It grows both in wild and cultivated forms and is well known for its pleasant aroma and therapeutic properties. The leaves and stems of *Mentha asiatica* are particularly valued for their medicinal benefits, with the essential oils extracted from its leaves being widely used in traditional medicine [1].

The chemical composition of *Mentha asiatica* includes a variety of bioactive constituents:

1. **Essential Oils**: Menthol (40–70%) is the major active compound known for its cooling effect; menthone has analgesic and antiseptic properties. Other components such as isomenthone, menthyl acetate, limonene, and pulegone contribute both aromatic and therapeutic effects.

2. **Flavonoids**: Includes apigenin, luteolin, and eriocitrin, which are recognized for their antioxidant activities.

3. **Phenolic Compounds**: Possess strong antioxidant activity and contribute to anti-aging effects at the cellular level.

4. **Tannins (Polyphenols)**: Provide anti-inflammatory and antibacterial properties.

5. **Acidic Compounds**: Rosmarinic and caffeic acids enhance immune function and exert anti-inflammatory effects.

6. **Vitamins and Minerals**: Rich in vitamins A and C, as well as essential trace elements such as iron, calcium, and magnesium [2].

Due to these properties, natural antioxidants derived from plants—particularly phenols, flavonoids, and essential oils—play a significant role in protecting the human body from oxidative stress caused by free radicals. One of the most widely applied methods for evaluating antiradical activity in plant extracts is the DPPH (2,2-diphenyl-1-picrylhydrazyl) assay. This method measures the degree of discoloration of the purple DPPH solution as it interacts with antioxidant molecules, indicating radical scavenging activity. The absorbance is typically measured spectrophotometrically at a wavelength of 517 nm [3].

Mentha asiatica, being rich in essential oils and polyphenolic compounds, has demonstrated significant biological activity in previous studies. Traditionally used for its anti-inflammatory, antiseptic, and sedative effects, its antioxidant potential makes it a promising candidate for scientific validation and application in pharmacological formulations [4,5].

This study aims to evaluate the antiradical (antioxidant) activity of *Mentha asiatica* leaf extract using the DPPH radical scavenging assay. The findings will contribute to a better understanding of its therapeutic potential and support the development of natural antioxidant-based health supplements.

Materials and Methods

Preparation of DPPH Working Solution. A 7.92 mM solution of DPPH• (2,2-diphenyl-1-picrylhydrazyl) was prepared in ethanol using a 100 ml volumetric flask. The solution was wrapped in aluminum foil to protect it from light and stored at room temperature for 30 minutes to stabilize before use.

Preparation of Plant Extracts. Samples were prepared from *Mentha asiatica* (Asian mint) leaves collected from Uzbekistan. For extraction, 1 gram of dried plant material was placed in a conical flask with 25 ml of 96% ethanol. The mixture was subjected to ultrasonic extraction using a bath sonicator at 60 °C for 20 minutes. The resulting extract was filtered through a 0.45 µm syringe filter to remove particulates and obtain a clear solution suitable for analysis [6]. The filtered extract was subsequently diluted tenfold with ethanol before further testing.

Determination of Antiradical Activity. To evaluate the antioxidant activity of the extract, a quartz cuvette (4 ml volume) was used. For the control (blank) measurement, 3 ml of DPPH solution was mixed with 100 µl of ethanol and placed into the cuvette. The sample was then analyzed using a K7000 spectrophotometer (manufactured by YOKE, China), and the absorbance was recorded at 517 nm every 5 minutes over a period of 30 minutes (denoted as D_1).

Results and Discussion

For the test samples, 25, 50, 75, and 100 µl of the diluted extract were each mixed with 3 ml of DPPH solution. The total volume in the cuvette was adjusted to 3.1 ml using ethanol. Absorbance readings (D_2) were recorded at the same wavelength (517 nm) and time intervals as the control. The antiradical activity percentage (ARF%) was calculated using the following formula:

$$ARF\% = \frac{D_1 - D_2}{D_1} \cdot 100\%$$

Table 1. Absorbance values and calculated antiradical activity (%) of blank and ethanol-extracted samples added to DPPH solution.

Volume, µl	Time, min.	Sample					
		Abs, D	ARF%		Time, min.	Abs, D	ARF%
25	0	0,967	0,00	75	0	0,967	0,0
	5	0,933	3,52		5	0,876	9,4
	10	0,935	3,31		10	0,874	9,6
	15	0,936	3,21		15	0,874	9,6
	20	0,938	3,00		20	0,875	9,5
	25	0,939	2,90		25	0,878	9,2
	30	0,938	3,00		30	0,874	9,6
50	0	0,967	0,00	100	0	0,967	0,00
	5	0,896	7,34		5	0,854	11,69
	10	0,895	7,45		10	0,848	12,31
	15	0,896	7,34		15	0,848	12,31
	20	0,895	7,45		20	0,846	12,51
	25	0,896	7,34		25	0,846	12,51
	30	0,896	7,34		30	0,845	12,62

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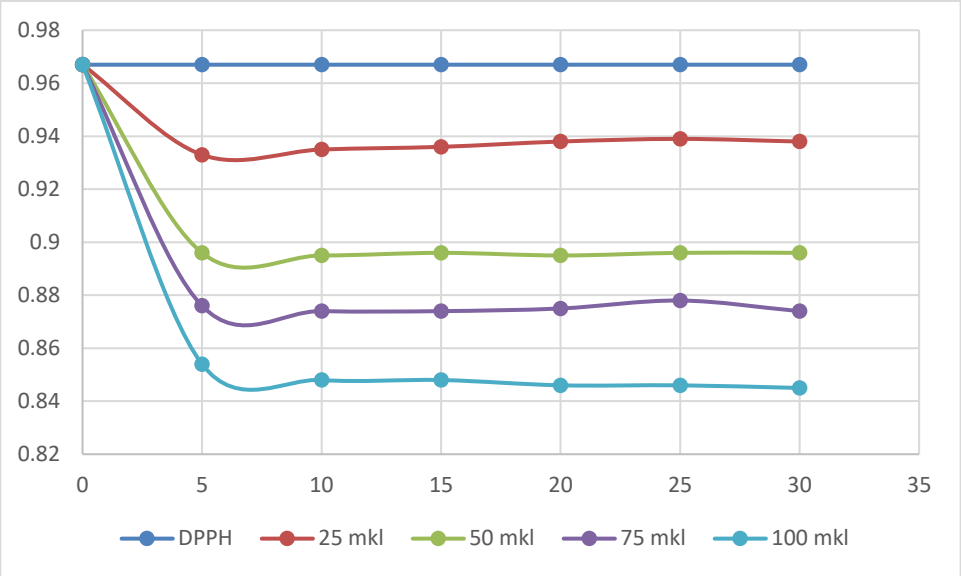

Figure 1. Graphical representation of the measured light absorption of blank and tested alcohol extracted sample solutions added to DPPH solution.

To calculate the IC_{50} of the samples - the concentration of inhibition of the DPPH solution to 50%, the following graph was constructed based on the antiradical activity (ARF%) values at 30 minutes in each experiment and the volume of alcohol samples added, and the trend line function applied to it was calculated.

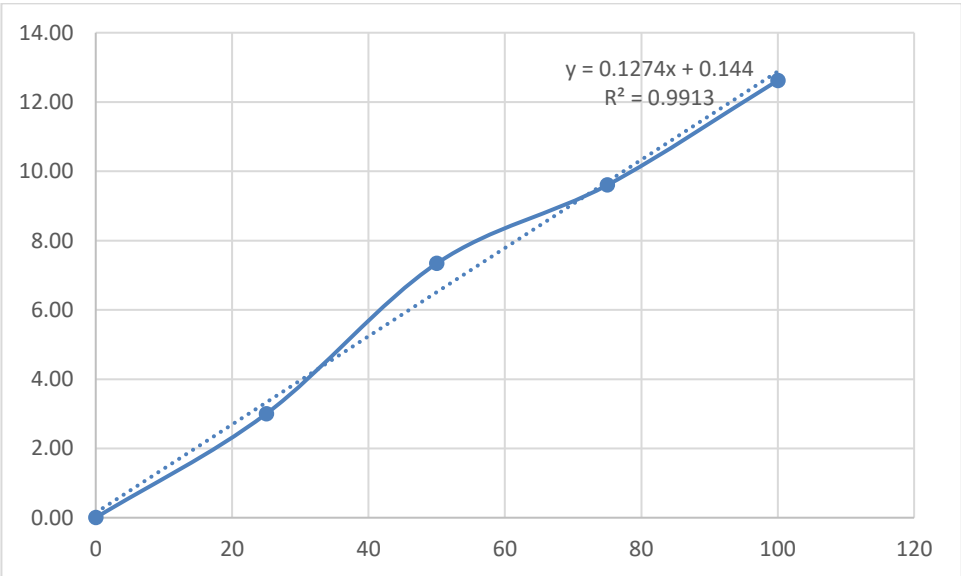

Figure 2. Graph of the relationship between ARF% and volumes determined at 10 minutes of an alcohol extracted sample.

The trend line plotted on the graph was calculated from the formula y=mx+b, which is the volume that exhibits 50% ARF% (IC_{50}) x=(y-b)/m:

$$IC_{50} = \frac{(50 - 0.144)}{0.1274} = 391.33\mu l$$

This study aimed to evaluate the antiradical (antioxidant) potential of the ethanol extract of *Mentha asiatica*, commonly known as Asian mint, through the spectrophotometric DPPH assay method. The plant, known for its pleasant aroma and wide use in traditional medicine, is rich in bioactive compounds such as essential oils (e.g., menthol, menthone, isomenthone), flavonoids (e.g., apigenin, luteolin, eriocitrin), phenolic acids (e.g., rosmarinic and caffeic acids), and vitamins (A and C), as supported by prior phytochemical investigations.

Using the DPPH method, which is a reliable and widely accepted technique to assess free radical scavenging capacity, this research revealed that the *Mentha asiatica* extract demonstrates a moderate antioxidant activity, with an IC_{50} value of 391.33 µL. Among various concentrations tested (25, 50, 75, 100 µL), the radical scavenging activity reached a maximum of 12.6%, confirming the plant's ability to neutralize DPPH free radicals.

These findings support the ethnobotanical uses of *Mentha asiatica* in managing oxidative stress-related conditions such as inflammation, nervousness, insomnia, and cardiovascular disorders. The observed antiradical activity is attributed to the synergistic effects of essential oils and flavonoids, which not only provide antioxidant defense but also confer mild sedative and calming effects on the central nervous system.

In conclusion, *Mentha asiatica* exhibits promising potential as a natural antioxidant source. The experimental results validate its traditional usage and pave the way for its incorporation into functional foods, dietary supplements, and herbal formulations aimed at stress reduction and oxidative stress management. Future research should focus on isolating specific bioactive constituents, conducting in vivo efficacy studies, and exploring clinical applications to fully harness its pharmacological potential.

Conclusion

The results of this study demonstrate that *Mentha asiatica* (Asian mint) possesses moderate antiradical (antioxidant) activity, as assessed by the DPPH spectrophotometric method. With an IC_{50} value of 391.33 µL and a maximum scavenging activity of 12.6%, the ethanol extract of this plant exhibits a significant ability to neutralize free radicals. This activity is attributed to the presence of various bioactive compounds in the leaves, including menthol, menthone, rosmarinic acid, flavonoids such as apigenin and luteolin, as well as essential vitamins and minerals.

The observed antioxidant potential supports the traditional medicinal use of *Mentha asiatica* in the treatment of stress-related and inflammatory conditions. Its sedative effects, likely resulting from the synergy of essential oils and phenolic compounds, further enhance its therapeutic value.

Therefore, *Mentha asiatica* can be considered a valuable natural source of antioxidants. These findings encourage further research into its phytochemical composition and

biological activity, including clinical trials and product development for use in nutraceuticals, herbal medicines, and functional foods. The plant holds promise for future applications in health promotion and disease prevention, especially in the context of oxidative stress-related disorders.

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