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Chemical Composition and Anti-Radical Activity of the “Bo‘stonliq” Almond Flower

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Abstract: This study presents a comprehensive investigation of the chemical composition and antiradical activity of almond (Prunus amygdalus) flowers of the “Bo‘stonliq” variety. The antioxidant potential of ethanolic and aqueous extracts was comparatively evaluated using the DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay.

Dried almond flower samples were subjected to ultrasonic-assisted extraction in 96% ethanol and distilled water. The radical scavenging activity (ARF%) and IC_{50} values were determined through spectrophotometric analysis at 517 nm and mathematical modeling.

The results demonstrated that the ethanolic extract exhibited significantly higher antiradical activity (IC_{50} = 338.66 µL) compared to the aqueous extract (IC_{50} = 718.2 µL). This difference is attributed to the higher solubility and extraction efficiency of phenolic compounds in ethanol.

The findings confirm that almond flowers are a promising natural source of antioxidants and highlight their potential application in food preservation, pharmaceuticals, and biotechnology. Moreover, this study emphasizes the importance of utilizing plant-based agro-industrial by-products for the development of high-value functional products.

Keywords: Almond flower, Prunus amygdalus, Bo‘stonliq variety, DPPH assay, antioxidant activity, phenolic compounds, ethanolic extract, aqueous extract.

Introduction: Almond (Prunus amygdalus), a member of the Rosaceae family, is one of the most economically and nutritionally important nut-bearing plants cultivated worldwide. It is native to Central Asia and the Middle East, where it has been traditionally used both as a food source and in folk medicine.

In recent years, increasing attention has been directed toward plant-derived bioactive compounds due to their health-promoting properties. Among these, phenolic compounds and flavonoids play a crucial role as natural antioxidants. Almond flowers, although less studied compared to seeds and hulls, represent a rich source of such compounds.

Phenolic compounds in almond flowers may constitute up to 1.5% of dry weight, with flavonoids accounting for nearly half of this fraction. These compounds are known for their ability to donate hydrogen atoms or electrons, thereby neutralizing free radicals and preventing oxidative damage.

Oxidative stress, caused by an imbalance between free radicals and antioxidants, is associated with various chronic diseases, including cardiovascular disorders, cancer, and neurodegenerative conditions. Therefore, the identification of new natural antioxidant sources is of significant scientific and practical importance.

Despite the global interest in almond-derived bioactive compounds, limited data are available regarding the antioxidant properties of local Central Asian varieties. The “Bo‘stonliq” variety, developed under regional conditions, remains largely unexplored.

This study aims to fill this gap by evaluating the antiradical activity of ethanolic and aqueous extracts of “Bo‘stonliq” almond flowers using the DPPH method. The use of ultrasonic extraction enhances the efficiency of compound recovery, while ethanol ensures optimal solubilization of phenolic constituents.

METHODS

1 Chemicals and Reagents

DPPH (2,2-diphenyl-1-picrylhydrazyl) reagent, ethanol (96%), and distilled water were used. All chemicals were of analytical grade.

2 Preparation of Plant Material

Almond flowers were collected, cleaned, and dried at 35°C to preserve thermolabile compounds. The dried material was ground into a fine powder for extraction.

3 Extraction Procedure

One gram of plant material was extracted with 25 mL of solvent (ethanol or distilled water) using an ultrasonic bath for 20 minutes. The extracts were filtered through a 0.45 µm membrane filter.

Ultrasonic extraction enhances mass transfer and disrupts plant cell walls, leading to higher yields of bioactive compounds.

4 DPPH Radical Scavenging Assay

A 7.92 mM DPPH solution was prepared in ethanol and stored in the dark for stabilization. The assay was performed by mixing 3 mL of DPPH solution with varying volumes of extract (25–100 µL).

Absorbance was measured at 517 nm at 5-minute intervals over 30 minutes using a spectrophotometer.

5 Determination of IC_{50}

The IC_{50} value, representing the concentration required to inhibit 50% of DPPH radicals, was determined using linear regression analysis:

RESULTS

The experimental results showed a clear dependence of antiradical activity on both extract concentration and reaction time.

The ethanolic extract demonstrated significantly higher activity at all tested concentrations. At 100 µL after 30 minutes, the ethanolic extract achieved 15.11% inhibition, whereas the aqueous extract showed only 6.88%.

The calculated IC_{50} values were:

- Ethanolic extract: 338.66 µL
- Aqueous extract: 718.2 µL

These results indicate that ethanol is a more effective solvent for extracting antioxidant compounds from almond flowers.

DISCUSSION

The higher antiradical activity of the ethanolic extract can be attributed to the efficient extraction of phenolic compounds, flavonoids, and other bioactive constituents. Ethanol, being a polar organic solvent, dissolves both hydrophilic and moderately lipophilic compounds, resulting in a more comprehensive extraction profile.

In contrast, water primarily extracts highly polar compounds and may fail to solubilize certain phenolics, leading to lower antioxidant activity.

The observed results are consistent with previous studies on plant-based antioxidants, which report higher activity in alcoholic extracts compared to aqueous ones.

Furthermore, the use of ultrasonic extraction likely contributed to improved yield and activity by facilitating cell wall disruption and enhancing solvent penetration.

From a practical perspective, the relatively low IC_{50} value of the ethanolic extract indicates strong antioxidant potential, making it suitable for industrial applications.

CONCLUSION

This study demonstrates that almond flowers of the “Bo‘stonliq” variety possess significant antiradical activity. The ethanolic extract showed nearly twice the effectiveness of the aqueous extract, confirming its superiority as a solvent for extracting antioxidant compounds.

The results highlight the potential of almond flowers as a natural source of antioxidants for applications in food preservation, pharmaceuticals, and cosmeceuticals.

Additionally, this research supports the sustainable utilization of plant materials and agro-industrial waste for the production of high-value bioactive products.

Future studies should focus on the identification and quantification of individual phenolic compounds and the evaluation of their biological activities in vivo.

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