

Assessment of antioxidant properties of *Prunella vulgaris*

Venelina Angelkova*, Ivan Svinyarov, Anely Nedelcheva, Milen G. Bogdanov

Faculty of Chemistry and Pharmacy, Sofia University "St. Kliment Ohridski", 1 James Bourchier Blvd.,
1164 Sofia, Bulgaria

Introduction

The common selfheal, *Prunella vulgaris* L. (Lamiaceae), also known in Bulgarian as "prishnitsa", is a pharmacopoeial medicinal plant (Common selfheal fruit-spike, Ph. Eur. 10.0, 2439: 01/2017), with a cosmopolitan distribution, diverse and contradictory ethnobotanical data on the used morphological parts and their application as a folk remedy. Rarely, the infusion of the aboveground parts is the application of the herb in Bulgarian traditional medicine.

A number of contemporary papers focus on review on the phytochemical constituents and pharmacological effect, which clearly show the potential of the selfheal as a medicinal plant with promising antibacterial, antiviral, anti-obesity, anti-inflammatory, anticarcinogenic, antihyperglycemic and immunomodulatory activities (Bai et al., 2016; Wang et al., 2019). A number of studies aim to evaluate the antioxidant and radical scavenging activity (Ahn et al., 2018; Feng et al. 2010; Li et al., 2015). Known data raise a number of questions about the relationship between environmental factors and the accumulation of secondary metabolites, the formation and transfer of traditional knowledge, and the evaluation of herb as a plant resource. Antioxidant and radical scavenging activity are one of the indicators that reflect the potential of benefit for human health. Data on the biological activities of morphologically different herbal substances (*Prunellae herba* u *Prunellae spica*) and their herbal preparations of different geographical origin are

relevant for the objective and reliable characterization of the species as a medicinal plant and for a real assessment of its prospects as a resource and source of natural compounds with biological activity. The aim of the study is to evaluate the antioxidant capacity of herbal substances *Prunellae herba* and *Prunellae spica* from Bulgarian populations.

Materials and methods

Plant material and extraction procedure

Plant samples from 14 localities (7 floristic regions) of *Prunella vulgaris* [PV] in Bulgaria were collected: flowering aerial parts (*Prunellae herba*) [PVh] and fruit-spikes (*Prunellae spica*) [PVs]. Plants sampled in various habitats at a wide range of altitudes (from 0 to 1740 m a.s.l.). Dried powdered drug of PVh and PVs was extracted by water and 20%, 40%, 60% and 80% ethanol (Ph. Eur. 10.0, 20814: 01/2008).

Quantitative estimation of total phenolic compounds

The total phenol content was determined by the method using the Folin–Ciocalteu reagent and were expressed as mg of pyrogallol (PG) equivalent per gram of dried weight sample.

Determination of (DPPH•) radical scavenging and superoxide (O₂•-) anion radical scavenging activity

The antioxidant capacity of the crude extracts was measured against 1,1-diphenyl-2-picrylhydrazyl (DPPH•) and superoxide (O₂•-) radicals as reported by Miliovski et al. (2015) with slight modifications.

* ohvma@chem.uni-sofia.bg

Results and discussion

Total phenolics content determination

The total phenolics content ranged from 6.5 ± 0.15 mg PG/g dw sample to 69.72 ± 1.44 mg PG/g dw sample of all the plants' extracts and varied significantly among the samples from the studied habitats. A significant difference was found among water extracts between the two kinds of herbal substances - PVh and PVs. The average amount for the PVh is much higher than for the PVs (44.54:13.71). In only two of the samples (high altitude habitat origin) was the difference below 10%. In addition, very high values were obtained for the same two localities (> 60.67 mg PG/g dw).

Comparison of antioxidant activity of different localities

It was shown that the antioxidant capacities of all extracts evaluated by DPPH• and superoxide ($O_2^{\bullet-}$) assays were in agreement with the content of total phenolics. The results showed that in all samples, the ethanol extracts had a higher amount of total phenolic, as well as higher antioxidant activities when compared to the water extracts. 40% ethanol and 60% ethanol extract demonstrated the greater radical scavenging activities. For most of the samples, the PVh extracts showed higher antioxidant activity than these obtained from PVs. The levels of total phenols and antioxidants activity obtained in this study are comparable with those reported for herbs with confirmed high health benefits (Pereira et al., 2014). Populations with valuable properties (antioxidant activity - a potential source of biologically active substances and plant material for research and cultivation) have been highlighted.

Conclusion

The results confirm the appropriateness of the use of the flowering aerial parts of the common self-heal in Bulgarian folk medicine as well as revealing the potential for using selfheal fruit-spike in addition to traditional knowledge. The potential of *Prunella vulgaris* of Bulgarian origin as a medicinal plant is underestimated and deserves to be further investigated in order to use them practically in the pharmaceutical and medicine fields.

Acknowledgements

Authors gratefully acknowledge the financial support of the Ministry of Education and Science under the project Young Scientists and Postdoctoral Fellows - 2019.

References

- Ahn, E.Y., Lee, Y.J., Park, J., Chun, P., Park Y., 2018. Antioxidant potential of *Artemisia capillaris*, *Portulaca oleracea*, and *Prunella vulgaris* extracts for biofabrication of gold nanoparticles and cytotoxicity assessment. *Nanoscale Res Lett.* 13(1), 34.
- Bai, Y., Xia, B., Xie, W., Zhou, Y., Xie, J., Li, H., Liao, D., Lin, L., Li, C., 2016. Phytochemistry and pharmacological activities of the genus *Prunella*. *Food Chem.* 204, 483–96.
- Feng, L., Jia, X., Zhu, M.M., Chen, Y., Shi, F., 2010. Antioxidant activities of total phenols of *Prunella vulgaris* L. in vitro and in tumor-bearing mice. *Molecules* 15(12), 9145–9156.
- Li, C., Huang, Q., Fu, X., Yue, X., Liu, R., You, L.J., 2015. Characterization, antioxidant and immunomodulatory activities of polysaccharides from *Prunella vulgaris* Linn. *Int. J. Biol. Macromol.* 75, 298-305.
- Miliosky, M., Svinyarov, I., Prokopova, E., Batovska, D., Stoyanov, S., Bogdanov, M.G., 2015. Synthesis and antioxidant activity of polyhydroxylated *trans*-restricted 2-arylcinnamic acids. *Molecules* 20, 2555–2575.
- Pereira, V.P, Knor, F.J, Velloso, J.C.R, Beltrame, F.L., 2014. Determination of phenolic compounds and antioxidant activity of green, black and white teas of *Camellia sinensis* (L.) Kuntze, Theaceae. *Rev. Bras. Plantas Med.* 16(3), 490–498.
- Wang, S.J., Wang, X.H., Dai, Y.Y., Ma, M.H., Rahman, K., Nian, H., Zhang, H., 2019. *Prunella vulgaris*: A comprehensive review of chemical constituents, pharmacological effects and clinical applications. *Curr Pharm Des.* 25(3), 359–369.