Available online at www.worldscientificnews.com

World Scientific News

WSN 73 (2017) 114-118 EISSN 2392-2192

Bioactive properties of elderflowers (*Sambucus nigra* L.)

Karolina Młynarczyk*, Dorota Walkowiak-Tomczak

Institute of Food Technology of Plant Origin, Poznan University of Life Sciences
28 Wojska Polskiego Str., 60-637 Poznan, Poland

*E-mail address: mlynk@up.poznan.pl

ABSTRACT

Elderflower is a valuable herbal raw material widely used in food, pharmaceutical and cosmetic industry. It is a rich source of bioactive compounds, such as polyphenols (e.g. chlorogenic acid, rutin, quercetin), that are responsible for their health benefits. Elderberry flowers demonstrate mainly diaphoretic, antipyretic, diuretic, antibacterial and anti-inflammatory properties and have been used in folk medicine as remedy for various ailments and diseases. The aim of the study was to evaluate selected bioactive properties of fresh and dried elderberry flowers, depending on the origin. Flowers were collected from three locations of wild elderberry shrubs and from three cultivars (Sampo, Haschberg, Samyl) growing on plantation. Methanolic extracts of fresh and dried flowers were analyzed in terms of the antioxidant activity using ABTS radical method and the total phenolic content by Folin-Ciocalteau reagent method. The results were statistically analyzed by Anova in Statistica 12.5 program. The obtained results indicate that drying process causes a deterioration of bioactive properties of elder flowers. Fresh flowers demonstrated significantly higher antioxidant activity as well as higher total phenolic content than dried flowers. Furthermore, flowers of wild elderberry differed from flowers of cultivated elderberry. In most cases, flowers of cultivars showed higher values of analyzed parameters compared to the wild elder flowers. The highest average antioxidant activity and the highest average content of total polyphenols was found in flowers of Sampo cultivar.

***Keywords*:** elderflower, *Sambucus nigra*, antioxidant activity, phenolic compounds

1. INTRODUCTION

Elderberry (*Sambucus nigra* L.) is a shrub or small tree belonging to the *Adoxaceae* family and reaching a height up to approx. 10 m. It grows wild in the territory of nearly the whole of central and western Europe, in western, central and north Asia, as well as in north parts of Africa [1, 2]. Almost all of the elderberry parts, such as flowers, fruits, leaves, bark and roots, have been known for its health benefits and have been used in folk medicine to treat various ailments and illnesses [3, 4]. Nowadays, the most commonly used are elderberry flowers and fruits, which are components of many food products, pharmaceutical preparations and cosmetics [5, 6].

Tiny, white or yellow-white elderberry flowers, gathered in large, dense, multifloral and flat umbels, are characterized by specific and intense aroma [3,6]. Elderflowers are a rich source of phenolic compounds and its content is even higher compared to elderberry fruits and leaves. The most important group of polyphenols included in elderflowers are hydroxycinnamic acids (e.g. chlorogenic acid, neochlorogenic acid, cryptochlorogenic acid). Furthermore, *Sambucus nigra* flowers contain flavonols (e.g. quercetin-3-rutinoside, kaempferol-3-rutinoside, isorhamnetin-3-rutinoside), flavanols (e.g. catechin, epicatechin) and flavanones (e.g. naringenin) [7-10]. Bioactive compounds of these flowers are responsible for their diaphoretic, antipyretic, diuretic, anti-inflammatory and antibacterial properties. In order to the therapeutic application, elderflowers are mostly used in dried form for the preparation of infusions [3]. Moreover, due to the sensory qualities, flowers of this plant are often used to improve the flavor of various beverages including alcohols, syrups, tea, yoghurts or desserts [11-13].

The aim of this study was to evaluate fresh and dried elderberry flowers, depending on the origin, in terms of bioactive properties including antioxidant activity and total phenolic content.

2. MATERIALS AND METHODS

2. 1. Plant material

Mature flowers of elderberry were harvested in June 2015, from three locations of wild elderberry shrubs growing in Poznań (W1, W2, W3) and from three cultivars (Sampo, Haschberg, Samyl) growing on plantation in Poznań area. Flowers were collected in the morning hours and immediately transported to the laboratory. Then umbels were cut discarding the tickest stalks. A part of elderflowers were dried in laboratory dryer at 40 °C for 5 hours.

2. 2. Sample preparation

Methanol extracts were prepared from fresh and dried elderflowers. 20 g of fresh flowers was added to 150 g of methanol 80% and mixed. The mixture was left for 24 h at 4 °C in the dark. After this time the mixture was separated by filtration using a vacuum pump. The extracts prepared were stored frozen until the analysis execution. Extracts of dried elderberry flowers were prepared in an analogous manner, but the weight of flowers was 2 g and the methanol weight was 100 g.

2. 3. Antioxidant activity

The antioxidant activity of fresh and dried *Sambucus nigra* flowers was determined by spectrophotometric method using ABTS radical cation (2,2'-azinobis(3-ethylbenzothiazoline-6-sulphonic acid)). The radical and the extracts were appropriately diluted with a buffer of pH 7,4. Extract samples were added to the ABTS solution and after an appropriate time of reaction at 30 °C, the samples absorbance was measured at 734 nm, by spectrophotometer Helios Alpha of Thermo Elektron Corporation. The results were expressed in μmol Trolox equivalent / 1 g dry weight [14].

2. 4. The total phenolic content

The total content of phenolic compounds in the analyzed elderberry flowers was assayed by spectrophotometric method using Folin-Ciocalteau reagent, which was added to diluted extracts. After 1 hour of reaction time in the environment of sodium carbonate, the absorbance of the samples was measured at 765 nm, by spectrophotometer Helios Epsilon of Thermo Fisher Scientific. The results were expressed in mg chlorogenic acid equivalent / 100 g dry weight [15].

2. 5. Statistical analysis

The results shown are the average values of triplicates with a standard deviation. In order to assess the significance of the effects of factors, the results were subjected to ANOVA variance analysis and Post-hoc HSD Tukey test at $p < 0.05$ in the Statistica program version 12.5.

3. RESULTS AND DISCUSSION

The results of the antioxidant activity of elderflowers are presented in Fig. 1. All of the analyzed fresh elderflowers showed significantly ($p < 0.05$) higher antioxidant activity compared to dried flowers. In most cases, flowers of cultivars exhibited higher antioxidant activity than flowers from shrubs of wild elderberry. The highest value of this parameter was found in the case of flowers of Sampo and Samyl cultivar.

The results of the total phenolic content are shown in Fig. 2. Similarly to the antioxidant activity, higher content of total polyphenols was found in fresh elderberry flowers in comparison to dried flowers and these differences were statistically significant ($p < 0.05$). The highest amounts of phenolic compounds were also recorded in flowers of Sampo and Samyl cultivars. The content of total polyphenols of fresh flowers is 5531 - 8156 mg chlorogenic acid / 100 g dry weight, corresponding to 1022 – 1623 mg chlorogenic acid / 100 g fresh weight. According to Mikulic-Petkovsek et al. [10], the total phenolic content is 10217 mg gallic acid / kg fresh weight, therefore this content is quite similar to the lowest content found in fresh elderflowers. Kołodziej and Drożdżal [7] found, that content of total polyphenols in dried elderberry flowers ranged from 37.02 to 53.33 mg caffeic acid / g dry weight, which is coincident with the results obtained in this paper. Christensen et al. [9], who studied 16 genotypes of *Sambucus nigra* flowers, found, that flowers of Sampo contained the highest amounts of selected phenolic acids (3-*p*-coumaroylquinic acid and 3,5-Di-caffeoylquinic

acid), however, Haschberg genotype was the richest source of 1,5-Di-caffeoylquinic acid and 3,4-Di-caffeoylquinic acid.

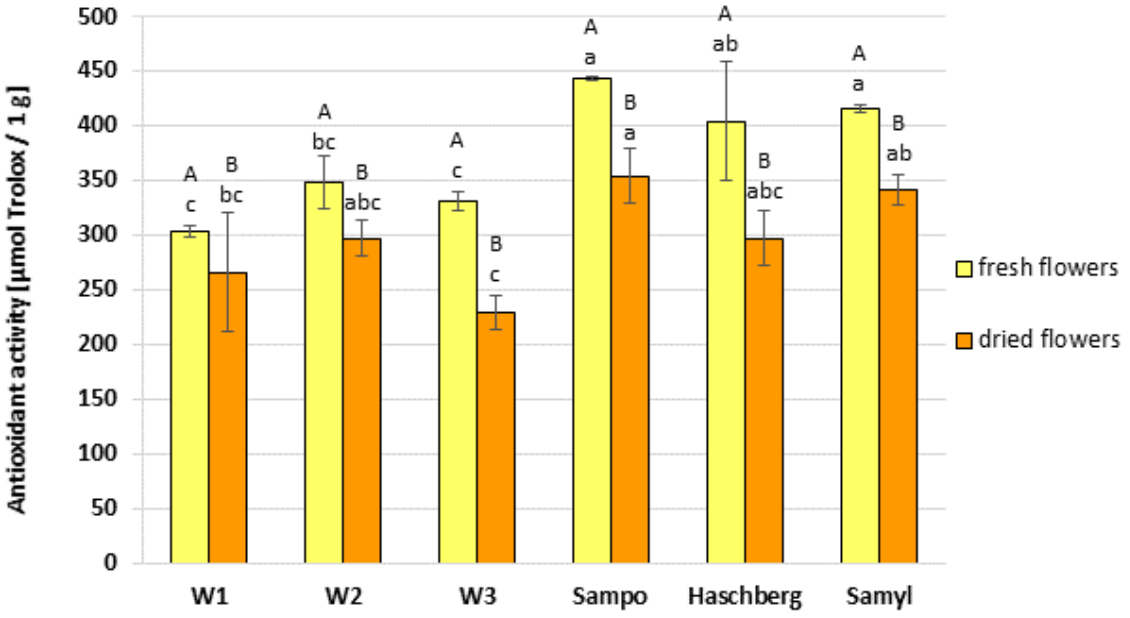

Figure 1. The antioxidant activity of fresh and dried elderflowers depending on the origin
A,B – differences between series significant at $p < 0.05$
a,b,c – differences in series significant at $p < 0.05$

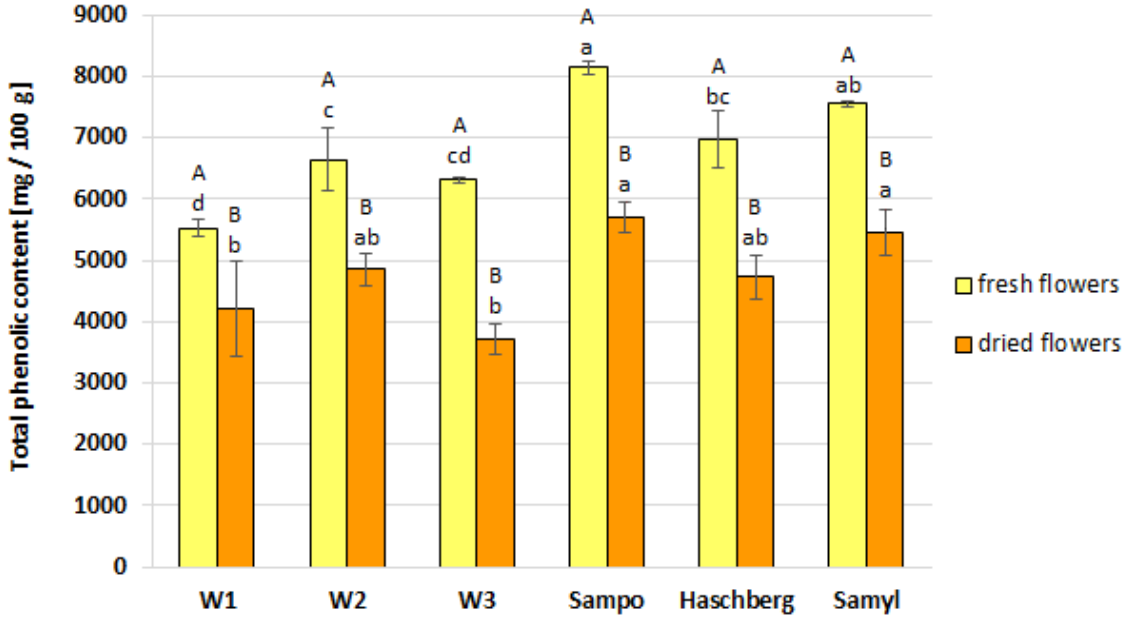

Figure 2. The total phenolic content in fresh and dried elderflowers depending on the origin
A,B – differences between series significant at $p < 0.05$
a,b,c – differences in series significant at $p < 0.05$

4. CONCLUSIONS

It was observed, that fresh elderflowers were characterized by stronger bioactive properties than dried flowers. In the majority, fresh and dried flowers of cultivars demonstrated higher values of analyzed parameters. The highest antioxidant activity and the highest total phenolic content was found in flowers of Sampo cultivar.

References

[1] E. M. Senderski, Zioła – praktyczny poradnik o ziołach i ziołolecznictwie. Liber (2009) 33-49, 194-197.

[2] K. Browicz, J. Zieliński, Atlas rozmieszczenia drzew i krzewów w Polsce 13 (1973) 17.

[3] A. Ożarowski, W. Jaroniewski, Rośliny lecznicze i ich praktyczne zastosowanie. Instytut Wydawniczy Związków Zawodowych, Warszawa (1987) 93-96.

[4] S. Kohlmünzer, Farmakognozja. Podręcznik dla studentów farmacji. Wydawnictwo Lekarskie PZWL, Warszawa (1998) 163-176.

[5] Z. Zakay-Rones, E. Thom, T. Wollan, J. Wadstein, *J. Int. Med. Res.* 32(2) (2004) 132-140

[6] A. Wierzbicki, *Wiadomości Zielarskie* 4 (2002) 8-10

[7] B. Kołodziej, K. Drożdżal, *Żywność. Nauka. Technologia. Jakość* 4(77) (2011) 36-44

[8] A. L. Dawidowicz, D. Wianowska, B. Baraniak, *LWT – Food Science and Technology* 39 (2006) 308-315

[9] L. P. Christensen, K. Kaack, X. C. Fretté, *Eur. Food Res. Technol.* 227 (2008) 293-305

[10] M. Mikulic-Petkovsek, J. Samoticha, K. Eler, F. Stampar, R. Veberic, J. Agric. Food Chem. 63 (2015) 1477-1487

[11] K. Kaack, L. P. Christensen, M. Hughes, R. Eder, *Eur. Food Res. Technol. 223* (2006) 57-70

[12] M. Tabaszewska, J. Słupski, Z. Lisiewska, A. Ślazyk, *Przemysł Fermentacyjny i Owocowo – Warzywny* 3 (2015) 14-16

[13] A. Fazio, P. Plastina, J. Meijerink, R. F. Witkamp, B. Gabriele, *Food Chem.* 140 (2013) 817-824

[14] R. Re, N. Pellegrini, A. Preteggente, A. Pannala, M. Yang, C. Rice-Evans, *Free Radical Biology and Medicine* 26(9/10) (1999) 1231-1237

[15] V. L. Singleton, J. A. Rossi, *American Journal of Enology and Viticulture* 16 (1965) 144-158

(Received 14 April 2017; accepted 08 May 2017)