Lucrări ştiinţifice **Zootehnie şi Biotehnologii**, vol. **41 (1)** (**2008**), Timişoara

ASSESSMENT OF ANTIOXIDANT PROPERTIES OF DRUPES

DETERMINAREA PROPRIETĂȚILOR ANTIOXIDANTE A DRUPELOR

PAULOVICSOVÁ B., TURIANICA I., BALOGHOVÁ, M., HABÁNOVÁ, M.

Faculty of Agrobiology and Food Resources, Department of Human nutrition, Slovak University of Agriculture, Nitra, Slovakia

In this work the content of anthocyans, vitamin C and the antiradical activity of selected species of drupes were evaluated by the spectrophotometric measurement. The highest concentration of anthocyan pigment was found out in blackthorn (Prunus spinosa L.). Cherries (Prunus avium L.) variants Újfehértói fürtös, Záhoráčka and Morella contain half times less of this plant pigment than the samples of blackthorn. Selected species of drupes are sources of natural vitamin C. Morellos (Prunus cerasus L.) contain higher concentration of ascorbic acid than cherries, but they have similar amount of this vitamin than plums (Prunus domestica L) variants Domáca veľkoplodá and Stanley. Surprisingly, it was evaluated exceptionally high value of antiradical activity in blackthorn, which reaches value: 461.25 % (EC_{50} = 0.1084 ± 0.0101). We can say that observed plant materials are important sources of nutritive compounds for composing dietary menu in healthy nutrition as well as for prophylaxis of toxic free radical accumulations along with connected civilization diseases.

Key words: drupes, anthocyans, antiradical activity, vitamin C.

Introduction

Considerable evidence now suggests that oxidants are involved in the development and clinical expression of coronary heart disease and those antioxidants may contribute to disease resistance. Consistent with this view is epidemiological evidence indicating that greater antioxidant intake is associated with lower disease risk. Although this increased antioxidant intake generally has involved increased consumption of antioxidant-rich foods (Tribble, 1999). Consumption of fruits and vegetables has been associated with reduced risk of chronic diseases such as cardiovascular disease and cancer. Phytochemicals, especially phenolic compounds, in fruits and vegetables are suggested to be the major bioactive compounds for the health benefits. However, the phenolic contents and their antioxidant activities in fruits and vegetables were underestimated in the literature, because bound phenolics were not included (Sun et al., 2002). Vitamin C belongs to significant antioxidants, which affect against whole range of compounds

with oxidative properties and free radicals. Apart from vitamin C most flavonoids have antioxidant properties, and extracts and juices of fruits and vegetables exhibit substantial antioxidant capacity in vitro. Therefore, it is conceivable that the health benefits of flavonoid-rich foods are related to the antioxidant protection of biological macromolecules, such as lipids, proteins, and DNA (Vinson, 1995). Two classes of flavonoids as antioxidants are considered in detail (anthocyanins and flavonols). Absorption of anthocyanins appears to be much less than that of the flavonol quercetin, perhaps as little as one tenth. Relatively high dietary levels of anthocyanins appear to be necessary to observe antioxidant effects in vivo (Prior, 2003).

In this work the content of anthocyans, vitamin C and the antiradical activity of selected species of drupes were evaluated.

Materials and Methods

The subjects of our measurement were: cherries *(Prunus avium* L.*)*– variants Újfehértói fürtös, Záhoráčka and Morella neskorá; morellos *(Prunus cerasus* L.*)*- variants Big jalovelsky, Burlat, Kordia, Van and Nitrianska belica; blackthorn (Prunus spinosa L.) and plums (*Prunus domestica* L.*)* variants Domáca veľkoplodá and Stanley. The analysed samples were harvested in phase of consumption ripeness and stored in frozen form.

1. Evaluation of anthocyans content

Principle of evaluation:

Anthocyan pigments were evaluated after extraction from solid materials with acidified ethanol or after direct solution of liquid samples with HCl in ethanol solution with the spectrophotometer measurement of absorption in absorption maximum (the method by Fuleki and Francis, 1968).

2. Evaluation of antiradical activity- DPPH method

The Principle of evaluation:

To evaluate the antiradical activity, a spectrophotometric method based on the reaction of antioxidants with a stable radical 2,2- diphenyl- 1- picrylhydrazyle radical (DPPH•) in methanol solution was used. The decrease of absorbance in the course of time at characteristic wavelength 515.6 nm is the evidence of reaction of the antioxidants from extracts with DPPH•, which signifies the evidence of antioxidants activity of extracts (the method by Sanchéz – Moreno et al., 1998).

2. The evaluation of vitamin C content

Principle of measurement:

The reduction properties of ascorbic acid are used in the measurement. A basic solution is made from the chopped sample with phosphoric acid, which is filtered. Then Fe (III) ions are added, which are reduced to Fe (II)-ions by ascorbic

acid. Thereinafter dipridyl reagent is added to the Fe (II)-ions, which results a red complex. The content of this complex is measured by spectrophotometer (a method by Lásztity and Törley, 1987).

Results and Discussions

Table 1

The content of anthocyans, vitamin C and the antiradical activity of selected drupes

Species of drupes	Content of anthocyans $g.kg^{-1}$	Content of vitamin C $mg.100g^{-1}$	Antiradical activity %
cherries *(Prunus cerasus* L.*)* variant **Újfehértói fürtös**	0.537 ± 0.001	17.405 ± 0.66	65.75 ± 3.11
cherries *(Prunus cerasus* L.*)* variant **Záhoráčka**	0.5 ± 0.003	21.57 ± 0.42	64.74 ± 0.003
cherries *(Prunus cerasus* L.*)* variant **Morella neskorá**	0.6169 ± 0.006	21.35 ± 1.77	64.35 ± 2.15
morellos *(Prunus avium* L.*)* variant **Big jalovesky**	0.1695 ± 0.012	21.83 ± 1.97	82.39 ± 1.89
morellos *(Prunus avium* L.*)* variant **Burlat**	0.0492 ± 0.012	11.08 ± 1.01	60.23 ± 1.86
morellos *(Prunus avium* L.*)* variant **Van**	0	13.075 ± 0.36	66.06 ± 2.32
morellos *(Prunus avium* L.*)* variant **Kordia**	0	19.65 ± 2.85	46.7 ± 4.57
morellos *(Prunus avium* L.*)* variant **Nitrianska belica**	0	12.29 ± 0.98	60.23 ± 2.45
blackthorn *(Prunus spinosa* L.*)*	1.71 ± 0.08	10.31 ± 1.06	EC_{50}= 0.1084 ± 0.0101* 461.25 %
plums *(Prunus domestica* L.*)* variant **Domáca veľkoplodá**	0	22.55 ± 0.25	52.1 ± 4.88
plums *(Prunus domestica* L.*)* variant **Stanley**	0	22.04 ± 0.58	51.1 ± 1.4

EC – express the 50% ability of plant material to scavenge free radical. This indicator was used to explain the antiradical activity, because this indicator reach too high values and it was impossibly to explain it via %.

From our results it follows, that observed species of plant materials cherries, morellos, blackthorn and plums are sources of natural form of vitamin C and have

good antiradical activity, as well as some species have a relative good content of anthocyans.

It was found out, that blackthorn provided the highest content of anthocyan pigments (1.71 ± 0.08g.kg^{-1}) from observed species of fruits. A similar result was confirmed by Gabrielska et al. (1999) who pointed out high content of anthocyan pigments in blackthorn. Cherries contain about third concentration of this plant pigment than the morellos. According to Jacobs (2003) cherries contain phenolic compounds, especially anthocyans. This fact was confirmed in our results. The lowest amount of anthocyans was found out in samples of morellos variant Burlat (0.0492 ± 0.012 g.kg^{-1}).

It is an interesting fact that the enormous high value of antiradical activity was found out in blackthorns (461.25 % = 0.1084 ± 0.0101), but they contained fewer vitamins C than cherries and morellos. It is showed that a high content of vitamin C and anthocyans does not mean high antiradical activity. The explanation of this fact lays in the synergic effect of antioxidants (including vitamins with antioxidative properties, quercetin, camferol etc.). Although the samples of morellos variant Big jalovelsky contain low amount of anthocyan pigments (0.1695 ± 0.012 g.kg^{-1}), their ability to scavenge free radicals was significant as the antiradical activity of above-mentioned species of drupes. A significant high antiradical capacity was found out in the morellos variant Van, cherries variant Újfehértói fürtös, Záhoráčka and Morella neskorá (in average values 66 – 64 %). A similar result was confirmed Connoly (2006), who reported, that numerous antioxidant and anti-inflammatory agents have been identified in cherries.

The richest source of vitamin C from analysed drupes is plum variant Domáca veľkoplodá, which contains 22.55 ± 0.25mg.100g^{-1} of this antioxidant vitamin. It was also found out high concentration of this nutrient in cherries (variants Záhoráčka and Morella neskorá) and morellos (variants Big jalovelsky and Kordia). Despite the fact, that the lowest content of vitamin C was observed in blackthorns (10.31 ± 1,06 mg.100g^{-1}), they are good source of anthocyans.

Conclusions

On the basis of our research, we can sum up, that observed plant materials are suitable natural sources of vitamin C, cherries and current variants of morellos content anthocyan pigments. The richest sources of anthocyans are blackthorns from analysed materials. Although the samples of blackthorns contain low amount of vitamin C, their antiradical capacity was very significant as the antiradical activity of other analysed species of drupes. The richest source of vitamin C from analysed fruits is plum variant Domáca veľkoplodá while the lowest content of this vitamin was observed in samples of blackthorns.

We can say that observed plant materials are important sources of nutritive compounds for composing dietary menu in healthy nutrition as well as for prophylaxis of toxic free radical accumulations along with connected civilization diseases.

Bibliography

1. **Connolly, DA et al.** (2006)- *Efficacy of tart cherry juice blend in preventing the symptoms of muscle damage*, Br. Sports Med., 40(8), pg. 679 -83.
2. **Fuleki, T. – Francis, F.J**. (1968)- *Quantitative methods for anthocyanins*, J. Food Sci.., vol. 33, 1968, p. 72-77.
3. **Gabrielska, J.- Oszmianski, J. – Komorowska, M. – Langner, M.** (1999)- *Anthocyanin axtracts with antioxidant and radical scavenging effect*, Z. Naturforsch (C), 54(5-6), pg. 319-324.
4. **Halvorsen, B.L**. (2002)- *A Systematic Sreening of Total Antioxidants in Dietary Plants – Nutrient Requirement*, The Journal of Nutrition, 132, 3; pg. 461
5. **Jacob, R.A.** (2003)- *Consumption of cherries lowers plasma urate in healthy women 1,2*, The Journal of Nutrition, 133, 6, pg. 1826.
6. **Lásztity, R. – Törley, D**. (1987)- *Alkalmazott élelmiszer – analitika. 2. kötet*. Budapest: Mezőgazdaság Kiadó, 307 oldal.
7. **Prior, R.L.** (2003)- *Fruits and vegetables in the prevention of cellular oxidative damage*, Am. J Clin.Nutr., 78(3 Suppl.), pg. 570-578.
8. **Sanchéz – Moreno, C. - Larrauri, J.A. – Sauro – Calixo, F.** (1998)- *A procedure to measure the antioxidant efficiency of polyphenols*, J. Sci. Food. Agric., vol. 76, pg. 270-276.
9. **Sun, J. – Chu YF. – Wu, X. – liu, RH**. (2002)- *Antioxidant and antiproliferative activities of common fruits*, J. Agri. Food Chem. 4, 50(25), pg. 7749-7754.
10. **Tribble DL** (1999)- *Antioxidant consumption and risk of coronary heart disease: Emphasis on vitamin C, vitamin E, and beta-carotene*, American Heart Association Science Advisory.,Circulation 99:591-595.
11. **Vinson et. al**. (1995)- *Plant flavonoids, aspacially tea flavonoids, are powerful antioxidants using an in vitro oxidation model for heart disease*, J. Agric. Food. Chem., 43, pg. 2800-2802.

Contacts:
Ing. Brigita Paulovicsová, Tr. A. Hlinku 2, 949 76 Nitra,
E-mail: paulovicsb@com.au
Ing. Mária Baloghová, Tr. A. Hlinku 2, 949 76 Nitra,
E-mail: riabalogh@gmail.com
prof. Ing. Ivan Turianica, Tr. A. Hlinku 2, 949 76 Nitra,
E-mail: Ivan.Turjanitsa@uniag.sk.

This work was supported by project G200 *(Uchovanie a trvalo udržateľné využívanie genetickej základne úžitkových druhov rastlín na Slovensku)*