Content of Bioactive Components in Chosen Cultivars of Cranberries (*Vaccinium vitis-idaea* L.)

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Abstract: The of relation between chosen macro- and microelements, total polyphenol (TP) and anthocyanin content (TA) and antioxidant capacity (TAC) in 6 selected cultivars of cranberries (Sussi, Linnea, Sanna, Runo Bielawski, Ida, Koralle) is the aim of this study. The influence of cultivars on macro- and microelements content was confirmed. The Mg content was in interval 478.3–555.2 mg/kg, K 5690–7690 mg/kg, Fe 10.7–29.3 mg/kg, Cr 0.5–0.8 mg/kg, Cu 3.5–5.0 mg/kg and Zn 8.1–9.8 mg/kg. The lowest Mg, Cr, and Cu contents were determined in cultivar Ida with the highest TP and TA contents. TA contents in observed cultivars were in interval 221.778–498.503 mg/kg, TP contents 1394.32–1605.62 mg/kg TAC 63.58%–68.13%. The statistically significant differences of all observed parameters among cranberry cultivars ($P < 0.05$) were confirmed. Also the positive correlations of TAC and TP as well as TA contents were significant. TP content is in the positive correlation with TA content.

Keywords: cultivars; cranberries; polyphenol; anthocyanin; antioxidant capacity

INTRODUCTION

Phenolic compounds are one of the most widely occuring groups of phytochemicals. They play an important role in growth and reproduction, providing protection against pathogens and predators (Bravo 1998). Phenolic compounds are ubiquitous in plants, and when plant foods are consumed, these phytochemicals contribute to the intake of natural antioxidants in human diet (Balasundram *et al*. 2006). The occurence of this complex group of substances in plant foods is extremely variable (Bravo 1998). Fruits and vegetables have low energy content, but high content of vitamins, essential micronutrients, dietary fibre. Fruits are also rich sources of phenolic compounds with high antioxidant activity but contain only small amount of some other antioxidants as CoQ10 (Tóth *et al*. 2008a). Plant phenolic components which have protective effects against cell oxidation impart bright colour to fruits and vegetables and act as antioxidants in the body by scavenging harmful free radicals (Kaur & Kapoor 2001). Anthocyanins are major plant colorants with antiradical and antioxidant activity (Tóth *et al.* 2008b). Also essential trace elements copper, zinc and selenium belong to natural antioxidants. Mentioned trace elements may affect antioxidant defence system (Magálová *et al.* 1997).

As with other fruit and vegetables, berries are important dietary sources of fibre and essential vitamins and minerals. They also contain a vast number of other phytochemicals for which there are no known deficiency conditions but which may have a potential health benefit. These include effects on oxidative damage, detoxification enzymes, the immune system, blood pressure, platelet aggregation and anti-inflammatory, antibacterial and antiviral responses (Beattie *et al*. 2005).

Cranberries are fruits with the excellent benefit on human health. They a rich source of macro- and microelements, vitamins and other positive effective phytochemicals. They help prevent urinary tract, bladder and kidney infections (help prevent of kidney stone formation) as well as can prevent cancer and cardiovascular diseases. Cranberries can

also decrease of LDL and increase HDL cholesterol level in human organismus. Antioxidant activity for LDL is associated directly with anthocyanins and indirectly with flavonols (Heinonen *et al*. 1998). Fruits od cranberries (*Vaccinium vitis-idaea*) are very favourit not only because of their high content of positive medicinal components, but also of specific taste. In the Slovakia wild cranberries occur from lowlands to high mountain localities. At present a lot of breeded cultivars with a high productivity are known.

The aim od this study is the observation of relationship between chosen macro- and microelements, total polyphenol (TP) and anthocyanin (TA) content and antioxidant capacity (TAC) in 6 selected cultivars of cranberries.

MATERIAL AND METHODS

The samples of 6 cranberries cultivars Sussi, Sanna, Ida, Koralle (middle early), Linnea, Runo Bielawski (middle late,) were obtained from the research breed station in Kriva on Orava. Locality of cranberry cultivation is characterised by altitude 700 m, average yearly temperature 6°C and precipitation 800 till 900 mm. From manually collected cranberries 100 g samples were weighted and stored in PE bags in freezing box at temperature –18°C. From cranberries samples 50 g were homogenised and extracted by 100 ml 80% ethanol during 12 hours. In obtained extracts total polyphenols and anthocyanins contents and antioxidant capacity were spectrophotometrically determined (Shimadzu UV/VIS – 1240). Total anthocyanins content was determined by modified method Lapornik *et al.* (2005). Into two tubes 1 cm^3 of extract was pipetted and 1 cm^3 0.01% HCl in 80% ethanol was added. Then 10 cm^3 14% HCl into the first tube and 10 cm^3 McIlvain agens (pH 3.5) into another tube were added. Absorbance was measured at 520 nm against blank sample. Total phenolics content were determined after Lachman *et al*. (1998) with using of Folin-Ciocalteu agens. Absorbance was measured at 765 nm against blank sample. Antioxidant activity was determined after Brand-Williams *et al.* (1995) with using of DPPH (2,2-diphenyl-1-picrylhydrazyl). Absorbance was measured at 515.4 nm and expressed as DPPH inhibition % (quatitative ability of observed component to scavenge the radicals in given time). The content of macro- and microelements after previous microwave decomposition was in cranberries samples determined by AAS method (AAS Varian AA Spectr DUO 240FS/240Z/UltrAA).

RESULTS AND DISCUSSION

The influence of cultivars on macro- and microelements is evident. Middle late cultivars of observed cranberries have higher Mg, K, Zn, and Cr (7, 14, 12, and 20%, respectively) and lower Fe (25%) and Cu (24%) contents than middle early cultivars (Table 1).

The phytochemical contents in cranberries are also depending on cultivar. The statistically significant differences of all observed parameters among cranberry cultivars ($P < 0.05$) were in this work confirmed. These results are in agreement with data published by Häkkinen *et al.* (1999). They confirmed, that concentrations of phytochemicals in berries are influenced by many factors including environmental conditions, degree of ripeness, cultivar, cultivation site, processing and storage of the fruit. Also Wang and Stretch (2001) documented, that the TAC of cranberry is affected by cultivars and storage temperature.

Table 1. Contents of macro- and microelements (mg/kg), total phenolics TP (mg/kg), total anthocyanins TA (mg/kg) and total antioxidant capacity TAC (%) in cranberries cultivars

Cultivar	Mg	K	Fe	Cr	Cu	Zn	TP	TA	TAC
Koralle	505.3	5860	15.7	0.7	5.0	8.1	1398.03	221.778	63.58
Ida	478.3	5760	14.2	0.5	3.5	9.6	1605.62	498.503	65.46
Sussi	521.5	5930	29.3	0.8	4.5	8.3	1519.32	413.909	68.13
Sanna	489.9	5860	22.8	0.6	3.7	9.0	1498.57	379.267	67.84
Linnea	555.2	5690	19.9	0.6	3.9	8.8	1394.32	303.418	67.27
Runo Bielawski	491.9	7690	10.7	0.6	3.5	9.8	1456.62	289.834	67.84

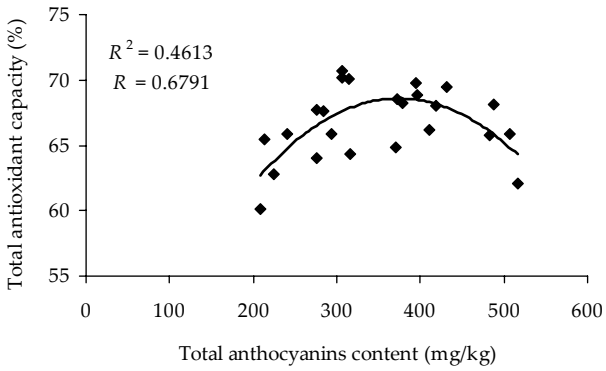

Figure 1. Relationship between total anthocyanins content and total antioxidant capacity

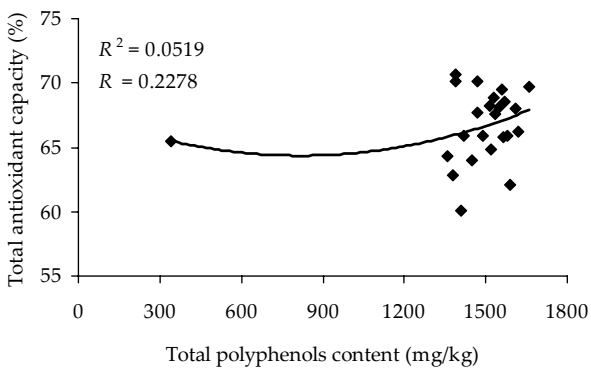

Figure 2. Relationship between total polyphenols content and total antioxidant capacity

Our results confirmed the strong statistical functionality between TAC and TP content as well as the weakly statistical functionality between TAC and TA content (Figures 1 and 2).

Kalt *et al*. (1999) documented, that TAC of small fruits (berries) is strongly correlated with the content of TP (0.83) and TA (0.90). After Velioglu *et al*. (1998) the correlation coefficient between total phenolics and antioxidative activities was statistically significant. The linear relationship between antioxidant capacity and anthocyanins or total phenolic content was confirmed by Prior *et al.* (1998).

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