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Total anthocyanine content and antioxidant density of some Hungarian sour cherry varieties

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Summary: Evidence suggests that a diet high in fruits and vegetables may decrease the risk of chronic diseases, such as cardiovascular disease and cancer, and phytochemicals including phenolics, flavonoids and carotenoids from fruits and vegetables may play a key role in reducing chronic disease risk. Recent research has proven that sour cherry (*Prunus cerasus* L.) is a valuable natural source of some bioactive compounds important in human health preservation. In our work, we identified the total antioxidant activity, anthocyanine content and *"antioxidant density"* of sour cherry varieties named "Újfehértói fürtös", "Debreceni bőtermő", "Kántorjánosi" and "Érdi bőtermő" and those of the "Bosnyák" sour cherry clones. "Antioxidant density" is a biological value indicator obtained in a synthetic way, which indicates the antioxidant capacity of the particular food, e. g. fruit and vegetable, related to 1 Calorie.

Key words: sour cherry, nutrient density, antioxidant density, anthocyanine, Hungary

Introduction

It is known that older people requires less energy but the demand for certain essential nutrients will not diminish. For instance, the need of protein or calcium do not decrease, in fact it even increases. In the aggregate, care should be taken that the so-called "nutrient density" of our aliment should be appropriately high. The nutrient density is a synthetic indicator introduced in the German technical literature, which expresses the amount of nutrient available in food, related to Calorie of the particular food article (*Schmiedel et al.*, 2004). In Hungary, a more conscious alimentation is of paramount importance from the point of view as death due to health problems attributable to improper nourishment in part or in whole is more and more frequent. According to statistical data, 687.1 of 100 thousand inhabitants died in Hungary in the year 2000 of cardiovascular diseases, being a group of diseases causing over half of the number of deaths. For the third of the number of deaths, the diseases of malignant tumours are responsible: 336 of 100 thousand people die due to this. The evolvement of diseases is mainly caused by improper way of living and by unhealthy nourishment. Abundant consumption of fruit and vegetables can reduce the rate of risk of the mentioned chronic diseases, which can be attributed to the antioxidant compounds (certain vitamins, polyphenols etc.) available in them (*Engelhart, 2002*). *Wang et al.* (1999) in their study related 17 antioxidant compounds available in the sour cherry and their role in preserving human health, concerning the achievements of which 10 USA patents have been granted since 1999. The studies covered the varieties "Montmorency" and "Balaton". The latter is of Hungarian origin, we call it "Újfehértói fürtös". In the mentioned varieties, high anthocyanine, bioflavonoid, melatonine and other bioactive components were measured, which have antinflammatory and cancer-preventive effects.

The aim of this study is to measure the total anthocyanine content of the mostly cultivated sour cherry varieties of Hungarian origin and to identify its *"antioxidant density"*. *The "antioxidant density" is a kind of synthetically generated biological value indicator, which indicates the antioxidant capacity of the particular food, e. g. fruit and vegetables, related to Calorie.*

Material and method

In our work, we identified the total antioxidant capacity of fruits, their anthocyanine content and *"antioxidant density"* . The studied sour cherry cultivars were cv. Újfehértói fürtös, cv. Debreceni bőtermő, cv. Kántorjánosi, cv. Érdi bőtermő and twelve 'Bosnyák' clones). In the summer of 2004, we washed, pitted and homogenised, with the use of a laboratory mixer, the fruit harvested at several growing locations, in optimally ripe condition. We stored the samples till the start of the tests at –18 °C. We determined its total antioxidant capacity (μmol ascorbic acid/litre), after the frozen sour cherry pulps have been thawed, at room temperature, by FRAP method (Ferric Reducing Ability of Plasma, after *Benzie-Strain,* 1996), by using tri-pyridyl-triazine. We conducted the absorbency measurements by means of Ultrospec 2100 pro (Amersham, USA) spectro-photometer at a wave length of 593 nm. The basis of this approach is that the antioxidant compounds, in acidic medium (pH=3.6), reduce the Fe(III) ions to Fe(II) ions, which Fe(II) ions can be measured photometrically. The absorbency is in direct ratio to the amount of the generated Fe(II) ions and that of the sample's antioxidant compounds. The total amount of anthocyanines was identified in conformity with the Hungarian Standards MSZ 14881 with the use of ethanol of hydrochloric acid content, at a wave length of 530 nm. To calculate the *"antioxidant density"*, we used the antioxidant capacity characterised by the FRAP value of the fruit of sour cherry varieties and clones examined (*Bíró & Lindner,* 1999). Finally, we calculated the antioxidant density in terms of FRAP UNIT (ascorbic acid) per Calorie, as follows:

$$\text{ANTIOXIDANT DENSITY – (FRAP UNIT ascorbic acid per Calorie)} = \frac{\text{measured FRAP value (μmol ascorbic acid/100 g of sample)}}{\text{Calorie of 100 g sample}}$$

Results and Discussion

According to our measurements, there was great difference in the total anthocyanine content of the tested nine Bosnyák sour cherry clones. We measured the lowest anthocyanine content of the clone B10 the 2.5-times of which was contained by the B11 clone (*Figure 1*).

In the case of the FRAP measurements, too, there were significant differences among the varieties. We observed two extreme FRAP values with the clones B6 and B5, as well. The measurement of the antioxidant capacity also covered the varieties Érdi bőtermő, Debreceni bőtermő and

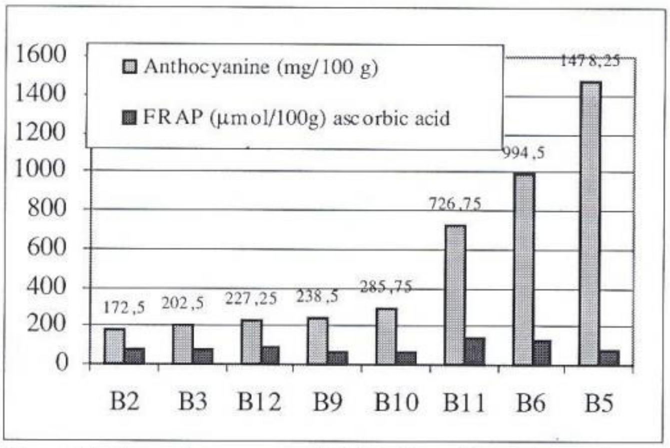

Figure 1 Anthocyanine content and FRAP values of Bosnyák sour cherry clones

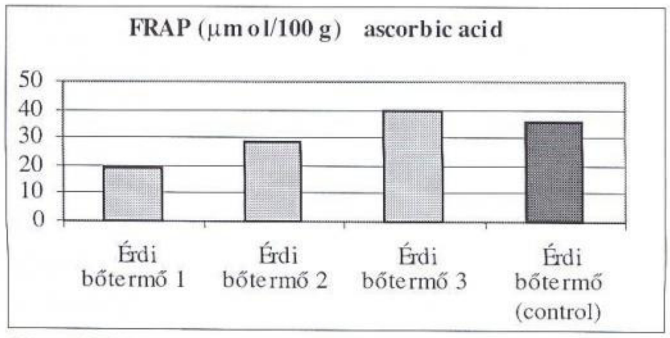

Figure 2 FRAP values one of the most cultivated Hungarian sour cherry varieties in relation to their harvest dates

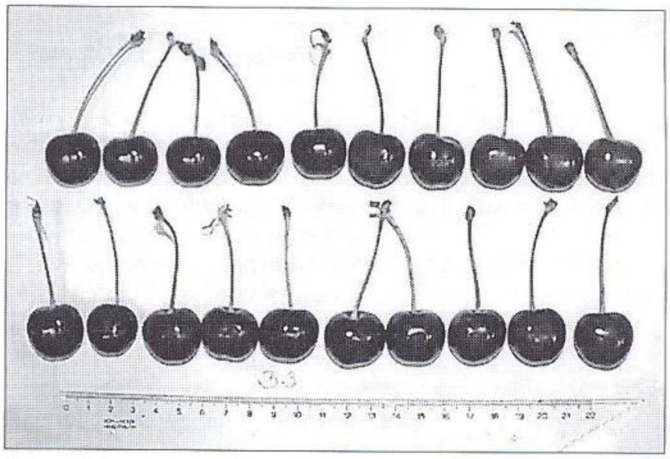

Figure 3 The ripe fruit of Bosnyák 3 sour cherry clone

Újfehértói fürtös. As for the Érdi bőtermő we tested fruit pieces harvested at three different stages of ripeness. The first harvest took place on 2004-06-21 (Érdi bőtermő 1). The second sample-taking took place 10 days after the first one (Érdi bőtermő 2), which was followed, after 10 days have elapsed again, by the third sample-taking (Érdi bőtermő 3). These sour cherry samples of the Érdi bőtermő derived from Pallag, from the orchard of the Department of Fruit Growing, and the Érdi bőtermő examined as control group came from Újfehértó, from the orchard of the Research Institute for Fruit Growing, the harvest date of which was 2004-06-22. The obtained results are shown by *Figure 2*.

Based on the measurements conducted in the year 2004, sour cherry varieties were graded into three categories. The varieties having lower FRAP value (30 to 40) included the Érdi bőtermő 1, 2, 3, the control samples and the varieties Debreceni bőtermő and the Újfehértói fürtös. For the nine Bosnyák clones, we identified, as a rule, much higher values. The tested Bosnyák clones also included such clones, which had lower antioxidant capacities (B10, B9, B3, B2, B5, B7, B12) and which had "extra" high values (B6 and B11, *Figures 3, 4* and *5*).

Data concerning the antioxidant density are shown by the values of the *Table 1, 2, 3*. If we accept that, by consuming fresh sour cherry of 100 g, we ingest 52 Calorie of energy on an average in our organism, then the intake of 1 Calorie can be achieved by consuming 1.92 g of sour cherry. This, in the case of the Bosnyák sour cherry clone

Figure 4 Bosnyák sour cherry tree in Csengőd village

B11 is equal to 2.75 FRAP UNITS, i. e. antioxidant intake. Accordingly, in the knowledge of the "antioxidant density" we can precisely identify the quantity of "antioxidant intake" one unit of energy intake will involve. We should prefer the Hungarian sour cherry varieties or clones of higher antioxidant density, both in the processing industry and marketing. We may as well make use of our results in the field of basic research.

We deem if we would identify the *"antioxidant density"* of our fruit cultivars and vegetables and that of our food articles being, as a rule, relevant in respect of antioxidant, so we shall be able to better serve our health by more proper nourishment in a manner that we shall be able to achieve maximum antioxidant ingestion with minimum calorie intake.

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Table 1, 2, 3 Antioxidant density of sour cherry varieties and clones

Bosnyák clones	FRAP UNIT (ascorbic acid)/ Calorie	FRAP (μmol/100 g) (ascorbic acid)
52 Calorie is in 100 g sour cherry (*Bíró, Lindner*,1999)		
B10	**1.27**	66.0
B9	**1.34**	69.7
B3	**1.4**	72.5
B2	**1.46**	76.2
B5	**1.58**	82.1
B7	**1.58**	82.2
B12	**1.6**	83.1
B6	**2.5**	130.5
B11	**2.75**	142.8

Different stages of clones	FRAP UNIT (ascorbic acid)/ Calorie	FRAP (μmol/100 g) (ascorbic acid)
52 Calorie is in 100 g sour cherry (*Bíró, Lindner*,1999)		
Érdi bőtermő 1	**0.37**	19.1
Érdi bőtermő 2	**0.55**	28.6
Érdi bőtermő 3	**0.77**	40.0
Érdi bőtermő (control)	**0.68**	35.5

Sour sherry varieties	FRAP UNIT (ascorbic acid)/ Calorie	FRAP (μmol/100 g) (ascorbic acid)
52 Calorie is in 100 g sour cherry (*Bíró, Lindner*,1999)		
Debreceni bőtermő	**0.58**	30.0
Újfehértói fürtös	**0.67**	34.9

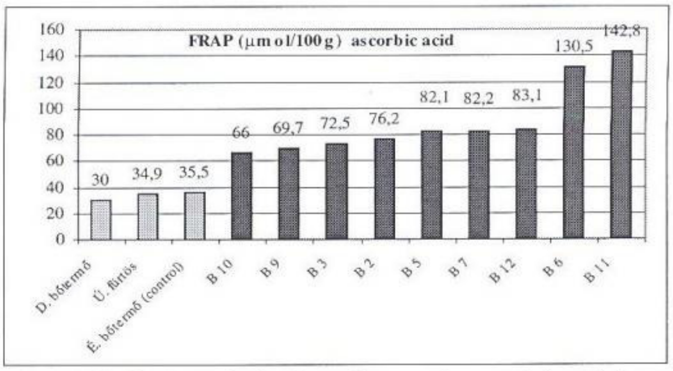

Figure 5 FRAP values of major Hungarian sour cherry varieties and clones

References

Benzie, I.F.F. & Strain, J.J. (1996): Ferric reducing ability of plasma (FRAP) as a measure of antioxidant power: The FRAP assay. Anal. Biochem. 239: 70–76.

Bíró Gy. & Lindner K. (1999): Nutrients table. Medicina Publishing House Co. Ltd. by Shares, Budapest, 285 (*in Hungarian*).

Engelhart, M.J. (2002): Dietary intake of antioxidants and risk of Alzheimer disease. Journal of the American Medical Association. 26: 3223–3229.

Schmiedel, V., Leitzman, C., Lützner, H. & Heine, H. (2004): Táplálkozástudományi kézikönyv a természetgyógyászatban. White Golden Book, Budapest, 400.

Wang, H., Nair, M. G., Stasburg, G. M., Booren, A. M. & Gray, J. I. (1999): Antioxidant polyphenols from tart cherries (*Prunus cerasus*). J. Agric. Food Chem. 47: 840–844.