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Antioxidant potential in selected species of small berry fruits

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The antiradical activity (% inhibition DPPH) as quality indicator of selected species of small berry fruits were observed. The analysis of their antiradical activity have shown that the highest values of inhibition of DPPH were found in blueberry (*Vaccinium corymbosum* L.) (78.95 %) and lingonberry (*Vaccinium vitis-idaea* L.) (68.89 %). The lowest values were found in bilberry (*Vaccinium myrtillus* L.) from area Stará Ľubovňa (50.54 %) and red currant (*Ribes rubrum* L.) (51.51 %). Between all selected species were recorded statistically significant difference ($P < 0.01$). Generally, small berries are consumed because of their attractive colour and special taste. The objective of this research is to highlight on their the health benefits because are considered one group of the richest sources of natural antioxidants with higher antiradical activity.

Keywords: small berries, antiradical activity, antioxidants, DPPH

1 Introduction

Overproduction of various radicals like reactive oxygen species (ROS) such as superoxide anion or reactive nitrogen species (RNS), such as nitric oxid and many further could lead to origin of oxidative stress. With the increasing aging of the world's population and simultaneously the lifestyle that society has today, the occurrence of oxidative stress in cells, and consequently, the production of mentioned radicals is also increasing, which has been related with a higher incidence of cardiovascular, cancer, brain and immune system diseases (Carocho, Ferreira, 2013). Actually, exist the classes of compounds also appear to have positive effects not just on the cardiovascular system, which may be due to their ability to act as free radical scavengers or by other mechanisms (Andriantsitohaina, et al., 2012). Mainly vegetables and fruits are abundant on polyphenols presented as a large class of natural compounds that have high antioxidant capacity and potential beneficial effects such as anti-inflammatory, anticancer, antifungal, antimicrobial, and antiulcer properties (Rahman, 2007). Several epidemiological studies have shown a significant cardio-protective effect of berries (Basu et al., 2010; Michalska et al., 2010), because are rich sources of antioxidants represented by vitamin C and polyphenols such as anthocyanins, phenolic acids, flavanols, flavonols and tannins. They are known as natural antioxidants, due to their high concentration and qualitative diversity and are increasingly often referred to as natural functional foods (Szajdek, Borowska, 2008). Generally, term berry fruits encompasses the so-called soft fruits, primarily blueberry, lingonberry, blackberry, strawberry, raspberry, currant and a lot of others.

2 Material and Methods

2.1 Material

Monitoring of the antiradical activity (% inhibition DPPH) in selected species of small fruits have implemented at the University of Aveiro in Portugal in the laboratory of the Department of Biochemistry. However, studied species of soft fruit were originating from the Slovak

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growing areas. Biological material was included: bilberry (*Vaccinius myrtillus* L.) from two different areas of Stará Ľubovňa and Oščadnica, further blueberry *(Vaccinium corymbosum* L.), lingonberry (*Vaccinium vitis-idaea* L.), blackberry (*Rubus fruticosus* L.), strawberry garden (*Fragaria x ananassa*), strawberry wild *(Fragaria vesca* L.) and red currant (*Ribes rubrum* L.). Those species berries were stored for four years at -20 °C in freezer, lyophilized subsequently and prepared for analysis in quadruplicate repetitions on the Department of Human Nutrition of the Slovak University of Agriculture in Nitra.

2.2 Methods

The antiradical activity of extracts of the tested samples have determined spectrophotometry by method DPPH (Brand - Williams et al., 1995). All samples were sufficiently homogenized for 30 seconds, prepared water extracts (1 g sample with 25 ml of distilled water) and after filtration subjected to on determining of the antioxidant activity.

Water samples of extracts (0.1 mL) were mixed with 2.7 mL of methanolic solution containing DPPH radicals (*2,2-diphenyl-1-picrylhydrazyl*). The mixture was shaken vigorously and left to stand in the dark until stable absorption values were obtained. The reduction of the DPPH radical was measured by monitoring continuously the decrease of absorption at 517 nm on the spectrophotometer Thermo Scientific GENESYS 20 (USA).

DPPH scavenging effect was calculated as percentage of DPPH discolouration using the equation: % scavenging effect = $[(A_{DPPH} - A_S)/A_{DPPH}] \times 100$, where A_S is the absorbance of the solution in time t (t = 10 minutes) when the sample extract has been added at a particular level and A_{DPPH} is the absorbance of the DPPH solution in time t (t = 0 minutes).

3 Results and Discussion

In water extracts monitored samples of berry fruits was recorded the average value of the antiradical activity 61.23 % inhibition of DPPH (Table 1).

Table 1 Descriptive statistics of average value the antiradical activity in samples berries

Qualitative indicator	Average	Median	Standard variation	Coefficient of variation %	Minimum	Maximum	Quantity
Antiradical activity (% inhibition DPPH)	61.23	59.28	10.1	16.49	49.44	82.98	32

Between studied species small berry fruits were confirmed highly significant differences of antiradical activity.

The highest antiradical activity (% inhibition DPPH) were found in blueberry (78.95 %) and lingonberry (68.89 %), between which were recorded statistically significant difference ($P < 0.01$). Also, was found high activity of blackberry (68.66 %). Medium value was recorded in bilberry from area Oščadnica, where was inhibition DPPH 62.57 %.

The lowest antiradical activity were found in bilberry (50.54 %), red currant (51.51 %), strawberry garden (53.40 %) and strawberry wild (55.33 %), compared with other studied species of small fruits. Similarly, Habánová (2011) found higher values of antiradical activity in blackberry (67.48 %) and lingonberry (63.55 %). In wild strawberry was recorded lower value % inhibition DPPH (55.54 %). Kalt et al. (2000) found a positive correlation relationship between the antioxidant capacity and concentration of total polyphenols. This finding agrees with data previously reported by other authors (Kačániová et al., 2008; Habánová et al.,

2013). Beliveau and Gingras (2005) reported that the antioxidant properties are a common feature of many plants and actually impede the action of free radicals, in particular in the oxidation of the blood vessel walls, causing a number of vascular diseases. However, it is necessary to affirm the limit of this theory and focus on food as a source of antioxidants.

4 Conclusions

Consumption certain types of small berries are protective to human health due to their antiradical power. The presence of high levels of antioxidants in these plant sources can provide scavenging of undesirable free radicals. Especially, our research have brought results that intake blueberry corymb (78.95 %), lingonberry (68.89 %) and blackberries (68.66 %) could be assigned to general diet of the population, because they accounted for berry fruits with the highest antiradical activity (% inhibition of DPPH) on statistical significance ($P < 0.01$).

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