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COMPARATIVE STUDY OF THE ANTIOXIDANTS CONTENT IN SOME BERRIES FRUITS

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Abstract

Berries fruits contain many different chemical compounds with different biological and pharmacological capacities and properties. So, these fruits are a source of bioactive molecules with antioxidant activity such as phenolic compounds, flavonoids, anthocyanins, ascorbic acid, that are important to human nutrition. Antioxidants neutralize free radicals, which cause oxidative damage to lipids, proteins, and nucleic acids and thus protect the organism. Research studies carried out on this topic indicated that natural antioxidants are involved in protection against many deseases: cancer, cardiovascular deseases, osteoporosis. The objective of this research was to determine and compare the antioxidants content offered by six berries fruits species: raspberry (Rubus idaeus), blackberry (Rubus fructicosus), strawberry (Fragaria ananassa), chokeberry (Aronia melanocarpa), blackcurrant (Ribes nigrum), sea-buckthorn (Hippophaea rhamnoides). The evaluation involved determination of total phenols, anthocyanins and flavonoids, using spectrophotometrical methods. Higher total phenol content levels were obtained in chokeberries and in blackcurrants.

Key words*: antioxidants, berries, polyphenols, anthocyanins, flavonoids, ascorbic acid.*

INTRODUCTION

Berries fruits contain many different chemical compounds with different biological and pharmacological capacities and properties. These fruits are a source of bioactive compounds with antioxidant activity such as phenolic compounds (flavonoids, anthocyanins) and ascorbic acid, that are important to human nutrition.

Antioxidants are compounds that protect cells against the damaging effects of reactive oxygen species involved in producing of oxidative stress, leading to cellular damage. Oxidative stress has been linked to cancer, aging, atherosclerosis, ischemic injury, inflammation and neurodegenerative diseases [Sies, 1997].

Anthocyanins are powerful antioxidants that give blueberries and strawberries their vibrant color. Anthocyanins may contribute to a smoother blood flow, leading to lower risk of high blood pressure. They have benefits for heart health and also for brain health and could reduce the risk for cancer and potentially help people live longer [Buhler and Miranda, 2000].

Flavonoids are polyphenolic compounds that have been identified in fruits, vegetables and beverages (tea, coffee, beer, wine and fruit drinks). The flavonoids have aroused considerable interest recently because of their potential beneficial effects on human health; they have been reported to have antiviral, anti-allergic, anti-inflammatory, antitumor and antioxidant activities [Wrolstad, 2001].

The objective of this research was to evaluate and to compare the level of several antioxidants in six berries fruits species: raspberry (*Rubus idaeus*), blackberry (*Rubus fructicosus*), strawberry (*Fragaria ananassa*), chokeberry (*Aronia melanocarpa*), blackcurrant (*Ribes nigrum*), sea-buckthorn (*Hippophaea rhamnoides*).

MATERIAL AND METHODS

Samples. Six berries fruits species: raspberry (*Rubus idaeus*), blackberry (*Rubus fructicosus*), strawberry (*Fragaria ananassa*), chokeberry (*Aronia melanocarpa*), blackcurrant (*Ribes nigrum*), sea-buckthorn (*Hippophaea rhamnoides*) were purchased from the local

supermarket. The determinations were performed in triplicate, using frozen fruits. The extractions were conducted according to the protocol used for each determination. Total phenols, anthocyanins and flavonoids were analysed using spectrophotometrical methods; the measurements were achieved with a UV/Visible ThermoSpectronic Helios spectrophotometer.

Total phenolic content was performed according to the modified Folin-Ciocalteu assay (Singleton *et al*., 1999). The method consists in chemical reduction of Folin-Ciocalteu reagent (which is a mixture of tungsten and molybdenum oxides) and measuring the intensity of the obtained blue colour at 750 nm. Total phenols values were expressed in terms of gallic acid equivalent, which is a common reference compound. **Anthocyanins content** was measured using the pH-differential method (Versari A. *et al.,* 2007). Each plants extracts dissolved in methanol were mixed with 2% HCl (pH 0.6), respectively with citrate buffer (pH 3.5). The absorbance was measured at 520 nm. The results were expressed as cyanidin-3-glucoside equivalents.

Flavonoid content was determined using a colorimetric method based on the reaction with aluminium chloride (Nickavar *et al.,* 2006). Briefly, 0.5 ml solution of each methanol plant extracts were mixed with 5 ml 10% sodium acetate, 2 ml 2,5% aluminium chloride and distilled water and left at room temperature for 45 minutes. The absorbance of the reaction mixture was measured at 420 nm. Total flavonoids content were calculated using a calibration curve and were expressed as quercetin equivalents.

The results were finally reported to the calculated dry matter of each sample.

Statistical analysis was performed using statistical package ANOVA.

RESULTS AND DISCUSSIONS

The biochemical analysis of the total polyphenols content revealed high values, especially for chokeberries and blackcurrant (table 1). A considerable amount of total polyphenols was found in strawberries, which is a positive information because these berries are the most prevalent on the market.

Table 1. Total polyphenols content

	Total polyphenols galic acid equiv. mg/100g	Standard deviation	Relative standard deviation %
Chokeberry	7791.6	695.5	8.93
Raspberry	1728.6	75.3	4.36
Blackberry	3340.2	134.2	4.02
Strawberry	4501.1	207.6	4.61
Blackcurrant	6339.1	312.8	4.93
Sea-buckthorn	2890.6	119.6	4.14

Regarding the level of anthocyanins, the highest one was found in blackcurrants, while the lowest one was in strawberries (table 2). This analysis didn't involve sea-buckthorn because the dark violet-blue color of anthocyanins is not one of their characteristics. The relative standard deviation values varied a lot among the triplicates, may be due to the fact that frozen fruits were subjected to analysis.

Table 2. Anthocyanins content

	Anthocyanins cyanidin-3-glucoside equiv. mg/100g	Standard deviation	Relative standard deviation %
Chokeberry	386.2	7.4	1.92
Raspberry	109	12	11.01
Blackberry	266.9	21.3	7.98
Strawberry	91.3	3.4	3.72
Blackcurrant	520	14.1	2.71

The total flavonoids content was rather high in all the analyzed samples (table 3). The high value was obtained for chokeberries. The level of flavonoids in sea-buckthorn is similar to that reported by Eccleston et al. (2002) who found flavonoid a content of 1182 mg/L sea-buckthorn juice.

Table 3. Total flavonoids content

	Flavonoides quercetin equiv. mg/100g	Standard deviation	Relative standard deviation %
Chokeberry	1793.3	23.2	1.29
Raspberry	536.6	25.7	4.79
Blackberry	591.2	11	1.86
Strawberry	662.8	31.7	4.78
Blackcurrant	1288.4	58.3	4.52
Sea-buckthorn	1379.9	45.1	3.27

A comparative analysis of phenolic antioxidants for the studied berries highlighted chokeberries and blackcurrants as the richest sources (fig. 1). The level of flavonoids was up to 50% from total phenolic content. The highest one was obtained for sea-buckthorn (47.7%) and the lowest one for strawberries (14.7%). The anthocyanins level was not more than 10% reported to the total phenolic compounds, ranging from 8.2% for blackcurrants and only 2% for strawberries.

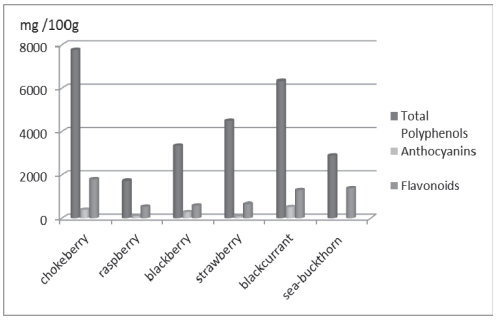

Fig. 1. Level of phenolics in berries

The high content of phenolic compounds found in the analyzed berries recommends them as excellent source of natural antioxidants with potential medicinal benefits.

CONCLUSIONS

The present study revealed the high content of phenolic compounds in several berries from Romania. Due to its considerable amount of phenolics, black chokeberries may be considered another important source of antioxidants, comparable with classical ones as blackcurrants and sea-buckthorn.

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