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Antioxidant activity assessment of some dried fruits

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Abstract

The aim of this work was to determine the antioxidant activity of some dehydrated fruits from Romanian market (goji berry, chokeberry, apricot, cranberry) and relationship with their content in certain antioxidant compounds: polyphenols, ascorbic acid and carotenoids. Ascorbic acid was determined by iodometric method. Dried goji fruit had the highest concentration of vitamin C (128.70 mg/100g), more than two times higher than the dehydrated chokeberries (61.25 mg/100g). The lowest concentration of ascorbic acid was found in apricots. Determination of carotenoids by the spectrophotometric method showed a very high concentrations of these compounds in goji berries (2597.45 µg/g). Regarding the content of polyphenols, determined by Folin –Ciocâlteu method, the highest concentration was found in the chokeberries (15.83 mg gallic acid/g), followed by the apricots (11.25 mg gallic acid/g) and goji berries (10.62 mg gallic acid/g). The antioxidant activity was determined by the CUPRAC method and the best value was found for the goji berries (185.32 mg Trolox/g), followed by chokeberries (145.37 mg Trolox/g).

Keywords: polyphenols, antioxidant activity, dried fruits, vitamin C, carotenoids.

1. Introduction

In recent years it has become evident that free radicals and reactive oxygen species affect the structure of DNA and cell membranes and thus induce various forms of cancer, the appearance of aging and various diseases caused by an unhealthy lifestyle. As a result, researchers have developed a number of methods for determining the antioxidant and antiradical activity of various foods and natural extracts to assess their protective quality on the human body [21]. Changes of the antioxidant and antiradical ingredients during various food processing are also highlighted by numerous studies [2, 13, 22].

Dried fruits provide many antioxidants and others health protective bioactive compounds [10,17].

Thus, dried apricots (*Prunus armeniaca*) are an important source of carotenoids, between that β - carotene is 60-70%. İncedayi *et al*., (2016) [24] analyzed β-carotene content and antiradical activity of dried apricots and they finding values between 45.96 - 93.29 mg/100g for β-carotene, respectively 43.34% -82.83% for antiradical activity (DPPH inhibition ratio). Goji berries (*Lycium Barbarum*) are very rich in polyphenols, carotenoids and vitamin C [1,6]. Zhang (2013) [23] evaluated the antioxidant activity of dried goji fruit to a value of 188.52 ± 1.3 µmol TE/g dry weight. Due to their chemical composition, very rich in important bioactive compouns, goji berries are used for thousands of years in traditional Chinese medicine, where they are believed to enhance immune system function, improve circulation, help eyesight, protect the liver and improve fertility, among other effects [14, 19]. Dried chokeberries (*Aronia melanocarpa*) also shows a very high biological and nutritional value. They contain many antioxidants, such as

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vitamin C (13–270 mg/kg), β-carotene (7.7–16.7 mg/kg), polyphenols (1578–8191 mg/100 g dry weight) [8, 12]. Dehydrated cranberries have been shown to have an undeniable action against a number of bacterial pathogens, cancer, cardiovascular disease, and the inflammation. These effects are determined to the wealth of biologically active substances, especially polyphenols, vitamins (ascorbic acid, riboflavin, tocopherols), β-carotene, minerals [5, 11].

The purpose of this paper is to analyze the antioxidant activity and the content in certain antioxidants (ascorbic acid, polyphenols, carotenoids) of some dried fruits from the Romanian market.

2. Methods and Methods

We have analyzed the following types of dried fruits purchased on the Romanian market: goji berry (*Lycium Barbarum*), chokeberry (*Aronia melanocarpa*), apricot (*Prunus armeniaca*) and cranberry (*Vaccinum vitis idaea*).

Experimental determination of ascorbic acid (iodometric method), polyphenols (Folin Ciocâlteu method) antioxidant activity (CUPRAC method) were conducted in accordance with the working methods presented by Dumbravă *et al*., (2016) [4].

Carotenoids extraction

In order to extract carotenoids, were weighed 5 g of each sample, they were grounded and then was triturated with a little quartz sand in a mortar with pestle. The extraction was carried out with a mixture of organic solvents (Sigma, Germany) consisting of petroleum ether: acetone: ethanol (6: 3: 1, v: v: v) by centrifugation at 5000 rpm for 5 minutes. The filtered supernatant was collected in brown glasses. The extraction operation was repeated with the new portions of solvent mixture until a colorless. Combined supernatants were then concentrated under vacuum at 45 ° C in a rotary evaporator to a small volume. Concentrated extracts were saponified by treatment with an alcoholic solution of KOH (Merck, Germany) 20% and leaving overnight in the dark. Saponified samples were placed in a separatory funnel and the carotenoids were extracted with petroleum ether.

Then the ether extract was washed with distilled water for complete removal of the soaps and alkali, afterwards traces of water were removed with anhydrous Na_2SO_4 (Chimopar, Bucharest). Dried samples were evaporated in vacuum to a small volume and then stored in brown bottle at -20 C, in nitrogen atmosphere, for testing [3, 16].

Spectrophotometric determination of carotenoids

For carotenoids analysis was used a UV-VIS spectrophotometer JASCO V-670 model. The absorbances of the samples were determined in petroleum ether, at the wavelength of 450 nm. The carotenoid content of the samples was calculated using the formula [16, 20]:

$$\mu g \text{ carotenoids/g plant material} = \frac{A \cdot V \cdot 10^4}{A^{1\%}_{1cm} \cdot m}$$

where:

A – is the sample absorbance at 450 nm;
V – analyzed extract volume (ml);
$A^{1\%}_{1cm}$ - specific absorption coefficient of β-carotene in petroleum ether (2592);
m – sample weight (g).

3. Results and discussion

Vitamin C content

The results concerning ascorbic acid content of the studied dehydrated fruits, are shown in Figure 1. It is observed that dried goji berries have the highest concentration of ascorbic acid (128.7 mg/100g), more than two times higher than the dehydrated chokeberries (61.25 mg/100g). Dried cranberries and dried apricots had quite close values of ascorbic acid concentration (33.02 mg/100g, respectively 25.37 mg/100g). The experimental results are within the limits shown in the literature data [7, 9, 15, 18, 23].

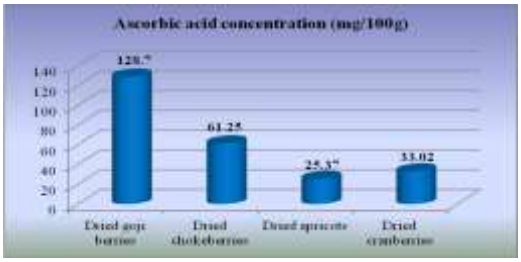

Figure 1. Ascorbic acid concentration of the analyzed dried fruits

Carotenoids content

The obtained results for carotenoids content in the dried fruits samples are shown in Figure 2.

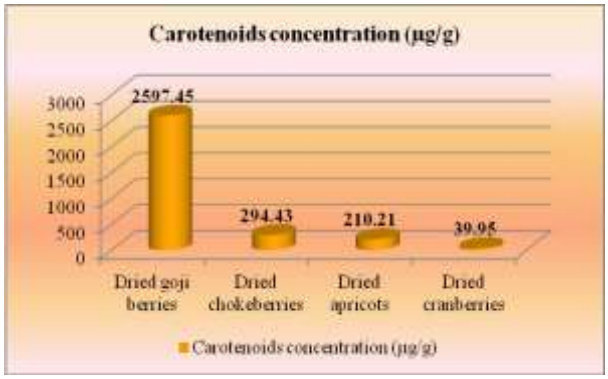

Figure 2. Carotenoids concentration of the dried fruits

Analyzing the experimental data results that goji berries have a very high level of carotenoids (2597.45 µg/g), net detaching it from the other analyzed dried fruits. Dried chokeberries have a carotenoid content of 294.43 µg/g, about 9 times lower than goji berries, and dried apricots have a content of 210.21 µg/g, more than 12 times lower than goji. The lowest content of carotenoid compounds was found in cranberries: 39.95, µg/g, 65 times lower than goji.

Total polyphenols content

The results of the total polyphenol content in the analyzed samples are shown in Figure 3.

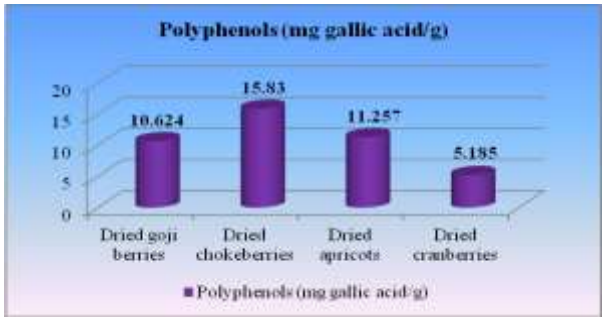

Figure 3- Polyphenols content in the analyzed dried fruits

It can be seen that dried chokeberries containing the highest amount of polyphenols (15.83 mg gallic acid/g), followed by apricots (11.257 mg gallic acid/g) and goji (10.624 mg gallic acid/g). The lowest polyphenols content was found in dried cranberries (5.185 mg gallic acid/g).

Antioxidant activity of the dried fruits

The results on the antioxidant activity of dehydrated fruits samples are shown in Figure 4.

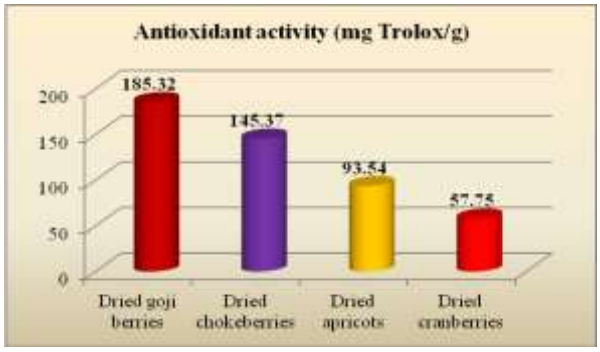

Figure 4. Antioxidant activity of the dried fruits

Following the experimental data it is found that the dried goji berries had the highest antioxidant activity (185.32 mg of Trolox/g), this berries having also the highest concentration of ascorbic acid and carotenoids, compounds with a strong antioxidant activity. Dehydrated chokeberries were after goji berries, regarding antioxidant activity (145.37 mg Trolox/g), chokeberries being the richest in polyphenols. Dried apricots had the antioxidant activity of 93.54 mg Trolox/g, and the lowest value of this parameter was for dried cranberries (57.75 mg Trolox/g).

4. Conclusion

1. Of the four dried fruits analyzed, the most powerful antioxidant activity was determined for goji berries. This result was in direct correlation with the highest values of the ascorbic acid and carotenoids concentrations which were found in goji berries.
2. Even if dried chokeberries had a much lower ascorbic acid and carotenoids content than goji, they had an antioxidant activity value pretty close of goji berries, in direct correlation with the fact that they presented the highest content of polyphenols of all dried fruits analyzed.
3. The lowest antioxidant activity was found in dried cranberries, which are the poorest in vitamin C, carotenoids and polyphenols, of the all analyzed samples.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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