BULGARIAN TRADITIONAL FOODS – SOURCES OF ANTIOXIDANTS

Silvia Tsanova-Savova¹, Vihren Petkov¹, Emil Vodenicharov² and Fanny Ribarova¹

Many scientific studies are focused on antioxidant activities in prevention, on their beneficial role for health status and age retardation. The main source of antioxidants for humans is the diet.

The aim of the study was to present data for antioxidant compounds in traditional Bulgarian foods, typical of Bulgarian diet.

The traditional foods selected for this study were: onion, pepper, tomatoes, green beans, apples, and wild fruit varieties – blueberries, blackberries, raspberries. Antioxidant vitamins E and C were determined by RP-HPLC/fluorescence and UV detection. Total phenolics were determined by the Folin–Ciocalteu assay. Total flavonoids were measured by the aluminum chloride assay. Total carotenoids were determined by RP-HPLC/UV-Vis.

The results showed that the highest amount of vitamin E was found in red peppers (2.94 mg/100g), and in raspberries (1.47 mg/100g), comparable with the level in sesame (2.4 mg/100g). Red peppers were evidenced to be the richest source of vitamin C (102 mg/100g). Total phenolics and total flavonoids as a marker of food antioxidant potential had the highest level in blueberries (670 mg GAE/100g, 190.3 mg CE/100g) and blackberries (355 mg GAE/100g, 55.5 mg CE/100g). Total carotenoids are mostly detected in tomatoes (7.70 mg/100g), followed by spring onion (3.50 mg/100g).

The modern analytical techniques enable the assessment of antioxidant constituents in some foods typical of the Bulgarian diet, and furthermore, on the basis of the results the assumption could be made that the Bulgarian longevity is associated not only with yogurt consumption, but with the abundance of antioxidants in the traditional diet as well. Acta Medica Medianae 2013;52(1):5-8.

Key words: antioxidants, phenolics, flavonoids, carotenoids, vitamins E and C, traditional foods

Medical University, Sofia – Medical College "Yordanka Filaretova"¹
Medical University, Sofia - Faculty of Medicine, Department of Hygiene, Medical Ecology and Nutrition²

Contact: Fanny Ribarova
Medical University – Sofia, Medical College
3 Yordanka Filaretova Str., Sofia 1606, Bulgaria
E-mail: fanny.r@mail.bg

Introduction

One of the current trends in nutritional science outlines the defense of traditional foods in response to the massive invasion of other cuisines, not typical of the diet of the respective population. Many researchers present evidence for the role of the traditional diet in health protection and in achieving longevity (1-4). Nutrigenomics also contributes and provides explanations in this aspect as well (5).

The defense of traditional foods could be realized only by comprehensive knowledge of their nutrient composition and content of bioactive components. The current achievements of analytical techniques provide this opportunity (spectrometry, gas and liquid chromatography with various detections). They have expanded significantly the spectrum of compounds that can be determined precisely in foods, aiming to assess their nutritional and biological value (6-9).

One hypothesis explaining the importance of food as preventive factor and factor for health protection and for retarding ageing processes is the "antioxidant hypothesis" confirmed by the studies of numerous researchers. A number of compounds having antioxidant activity were discovered and identified that, when included in the diet support the antioxidant protection of the organism. Some of them are compounds of the carotenoid, flavonoid, terpens, vitamins and other groups (10-14).

In the past, the longevity of the Bulgarian population was mainly associated with Bulgarian yogurt. Nowadays, the new scientific evidence enables us to state also the role of antioxidants provided by traditional Bulgarian foods.

The aim of the study was to present data for antioxidant compounds in traditional Bulgarian foods, typical of Bulgarian diet.

Materials and methods

The traditional foods selected for this study were: onion, pepper, tomatoes, green beans, apples, and wild fruit varieties – blueberries, blackberries, and raspberries, characteristic for mountain regions of the country.
Antioxidant vitamin E (α-Tocopherol) was determined by RP-HPLC with fluorescence detection (Ex=285 nm, Em=345 nm). Isocratic elution with methanol, flow rate 1.0 ml/min and temperature set at 400°C was applied. Sample treatment included saponification prior to extraction with KOH and ethanol. The limit of detection (LOD) of the method was 0.006 mg%, whereas the limit of quantitation (LOQ) was 0.02 mg%. The recovery rates were between 88-95%, and relative standard deviation RSD=10%.

Vitamin C was determined by RP-HPLC/UV detection at 254 nm and 350C by using ion pair chromatography with hexadecyl-trimethylammonium bromide as mobile phase modifier, and methanol/phosphate buffer with pH=5.5 elution (35:65 v/v). The analytical parameters of the method were as follows: LOD=0.02 mg%, and LOQ=0.05 mg%. The analytical recovery was 92%, and RSD=1.9%.

The total phenolic content of fruits and vegetables were determined by using the Folin-Ciocalteu assay. The determined analytical parameters of the total phenolics method were as follows: LOD = 0.4 mg GAE/100 g fresh weight; LOQ 1.2 mg GAE/100 g fresh weight; recovery 97% and reproducibility (RSD) 2.7 %.

The total flavonoid content was measured by the aluminum chloride colorimetric assay. The LOD was 0.6 mg CE/100 g fresh weight; LOQ - 1.8 mg CE/100 g fresh weight; recovery - 96% and reproducibility (RSD) - 3.7 % (15).

The total carotenoids content was measured as a sum of lutein, zeaxanthin, lycopene, β-cryptoxanthin, α-carotene, and β-carotene with RP-HPLC method using mobile phase of acetonitrile: methanol (95:5) (eluent A) and acetonitrile: methanol: ethyl acetate (60:20:20) (eluent B) with gradient elution: 100 % A for 5 min, followed by linear gradient to 100 % B at 13 min. The detection was carried out with UV-Vis detector at 450 nm. Carotenoids were quantified using external calibration method. The constructed six pointed calibration curves (n=3) were linear (correlation coefficients >0.99) in the working range: 0.04–5 µg/ml. The LOD and LOQ of the method for individual carotenoids varied within the range 0.45-0.86 µg%, and 1.35-2.57 µg%. The recoveries were very high – 95-103 %, and RSD very small – 2.5-4.7%.

**Results and discussion**

The results of the present study are shown in Table 1. All data refer only to edible portion and are expressed in mg/100 g of fresh weight of the sample. The results for total phenolics are expressed in mg gallic acid equivalent for 100 g, and for total flavonoids in mg (+)-catechin equivalent for 100 g food.

The results show the highest amount of vitamin E is in red peppers (2.94 mg%), followed by raspberries (1.47 mg%). In comparison with other dietary sources of α-Tocopherol, these levels are logically lower than those in plant oils, like sunflower-seed refined oil (44.9 mg%) or olive oil (11.9 mg%) for instance, but they are comparable with the vitamin E level in some seeds, like sesame (2.4 mg%). The quality of the eaten food determining the level of α-Tocopherol in the organism is also important.

**Table 1. Content of antioxidant vitamins E and C, total phenolics, flavonoids, and carotenoids in selected traditional Bulgarian foods**

<table>
<thead>
<tr>
<th>Food</th>
<th>Vitamin E mg/100g</th>
<th>Vitamin C mg/100g</th>
<th>Total Phenolics mg GAE/100g</th>
<th>Total Flavonoids mg CE/100g</th>
<th>Total Carotenoids mg/100g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onion</td>
<td>0.43</td>
<td>11.7</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Onion, spring</td>
<td>-</td>
<td>45.6</td>
<td>120.0</td>
<td>16.0</td>
<td>3.50</td>
</tr>
<tr>
<td>Pepper, red</td>
<td>2.94</td>
<td>143</td>
<td>173.2</td>
<td>13.7</td>
<td>1.20</td>
</tr>
<tr>
<td>Pepper, green</td>
<td>0.70</td>
<td>102</td>
<td>246.7</td>
<td>27.4</td>
<td>0.66</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>0.34</td>
<td>17</td>
<td>76.9</td>
<td>12.8</td>
<td>7.70</td>
</tr>
<tr>
<td>Green beans</td>
<td>0.02</td>
<td>16.6</td>
<td>35.5</td>
<td>4.1</td>
<td>0.54</td>
</tr>
<tr>
<td>Apple</td>
<td>0.61</td>
<td>5.76</td>
<td>112.6</td>
<td>41.7</td>
<td>0.76</td>
</tr>
<tr>
<td>Blueberry</td>
<td>-</td>
<td>3.5</td>
<td>670.9</td>
<td>190.3</td>
<td>0.29</td>
</tr>
<tr>
<td>Blackberry</td>
<td>0.61</td>
<td>14.23</td>
<td>355.3</td>
<td>55.5</td>
<td>0.44</td>
</tr>
<tr>
<td>Raspberry</td>
<td>1.47</td>
<td>26.3</td>
<td>178.6</td>
<td>26.6</td>
<td>0.37</td>
</tr>
</tbody>
</table>

(+) – not analyzed
more typical for the mountain regions of the country. According to the results, the antioxidant load of the traditional Bulgarian diet is divided—vegetable sources for lowland regions and seasonal fruit sources for mountain regions.

The carotenids are plant pigments with nutritive (α-Carotene and β-Carotene) and non-nutritive (Lutein, Zeaxanthin, Lycopene, and β-cryptoxanthin) properties. However, all representatives of this group have strong antioxidant potential. The total carotenoids are higher in tomatoes (7.70 mg/100g), followed by spring onion (3.50 mg/100g), and red peppers (1.20 mg/100g).

A wide spectrum of antioxidants dietary intake involves more effective defense against the free radicals and reactive oxygen spices, with all the mechanisms of bioavailability and bio-efficacy in place. However, the first stage of the assessment of this process is the recognition of the qualitative and quantitative composition of the dietary antioxidants in foods. On the basis of such detailed data, preventive diets and healthy nutrition regimes can be established.

**Conclusion**

The modern analytical techniques allow us to make the assessment of antioxidant constituents in some foods typical of the Bulgarian diet, and furthermore, on the basis of the results, the assumption could be made that the Bulgarian longevity is associated not only with yogurt consumption, but with the abundance of antioxidants in the traditional diet, too. Furthermore, the presented data can be used for establishment of a data base for antioxidants in foods characteristic of the Balkan region as Bulgarian traditional foods are an integral part of the Balkan diet.

**References**

1. Trichopoulou A, Vasilopoulou E, Georga K, Soukara S, Dilis V. Traditional foods: Why and how to sustain them. Trends in Food Science and Technology 2006; 17: 498-504. [CrossRef]
TRADICIONALNE BUGARSKIE NAMIRNICE – IZVORI ANTIOKSIDANATA

Silvia Tsanova-Savova, Vihren Petkov, Emil Vodenicharov i Fany Ribarova

Mnoge naučne studije bave se preventivnom ulogom antioksidanata i njihovim značajem za ljudsko zdravlje i usporavanje procesa starenja. Glavni izvor antioksidanata za ljude jeste ishrana.


Rezultati su pokazali da se najveća količina vitamina E nalazi u crvenoj paprici (2.94 mg/100gr) i u malinama (47 mg/100g), u odnosu na količinu ovog vitamina u susamu (2.4 mg/100g). Najbogatiji izvor vitamina C jeste crvena paprika (102 mg/100g). Najviši nivo fenola i flavonida kao markera antioksidanata u hrani prisutan je u borovnicama (670 mgGAE/100g, 190.3 mgCE/100g) i kupinama (355mgGAE/100g, 55.5 mgCE/100g). Karotenoidi su najviše prisutni u paradajzu (7.70 mg/100g), a potom u mladom luku (3.50 mg/100g).


**Ključne reči:** fenoli, flavonidi, karotenoidi, vitamini E i C, tradicionalne namirnice