ANTIRADICAL ACTIVITY, TOTAL PHENOLICS AND ANTHOCYANINS CONTENT OF DIFFERENT PLUM VARIETIES

ACTIVITATEA ANTIRADICALICĂ, CONŢINUTUL DE FENOLI TOTATLI SI ANTOCIANI LA DIFERITE SOIURI DE PRUNE

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Abstract. *In this study antiradical activity, total phenolics and anthocyanin content of fifteen plum varieties were investigated. The fruits were evaluated for antioxidant potential spectrometrically using DPPH• (1,1-diphenyl-2-picrylhydrazyl free radicals) scavenging test. From all plum fruit analzyed, three showed higher antiradical activity: Silvia (125± 2.36 µM Trolox/100 g), followed by Tuleu gras (109.71±1.25 µM Trolox/100 g) and Minerva (109.71± 1.05 µM Trolox/100 g). The total polyphenols and anthocyanin contents showed a great variety amongst plum varieties and highly correlation with the total antioxidant capacity. Both total polyphenols and anthocyanin are major contributors to the total antioxidant capacity in plum fruit.*

Key words: antiradical activity, plum, total phenolics.

Rezumat. *În acest studiu au fost investigate activitatea antiradicalică, conţinutul de compuşi fenolici totali şi conţinutul de antociani a 15 soiuri de prune. Potenţialul antioxidant al fructelor a fost determinat spectrofotometric cu ajutorul metodei DPPH (radical liber 1,1 difenil - 2- picrilhidrazil). Din toate probele de prune analizate s-au diferenţiat trei soiuri cu activitate antiradicalică mare: Silvia cu 125± 2.36 µM Trolox/100 g, urmată de Tuleu gras cu 109.71±1.25 µM Trolox/100 g şi de Minerva cu 109.71 µM Trolox/100 g. Soiurile de prune au arătat o mare varietate în ceea ce priveşte conţinutul de fenoli totali şi antociani dar si o bună corelaţie cu activitatea antiradicalică. Atât compuşii fenolici totali, cât şi antocianii contribuie la capacitatea antiradicalică a prunelor.*

Cuvinte cheie: activitate antiradicalică, prune, fenoli totali.

INTRODUCTION

Plums are an excellent source of nutrients that contribute significantly to human nutrition (Cao *et al*., 1997). They are also an important source of compounds that affect human health and prevent many diseases (Stacewicz-Sapuntzakis *et al*., 2001). In this context it is necessary to mention the importance of the content of anthocyanins, flavonoids, carotenoids and polyphenolic acids, compounds that contribute to the antioxidant capacity of fruits (Vinson *et al*., 2001).

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Plums contain large quantities of sodium, potassium, iron, magnesium, manganese, selenium, copper and vitamins A, E, B and C. Also very important are the specific organic acids, beta carotene, pectic substances and, not least, small amounts of oxalic acid and fumaric. Because of complex content, prunes are considered both classical and modern medicine, as well as by the alternative medicine a real prophylactic and curative for many diseases: gout, atherosclerosis, hepatitis, diabetes, food poisoning, rheumatism, pollution caused by toxic conditions etc. The same fruit have a positive effect on hypertensive due to potassium and organic acids that streamline blood. Also, compounds present in plum reduce blood cholesterol and its deposition on blood vessels. Because iron, plums are anemic and antiastenic medicine, decongests liver and reduce the risk of some types of cirrhosis, and copper prevents blood clots, reducing the risk of thrombophlebitis. Prunes are laxative and also reduce the risk of gastrointestinal mucosal inflammation, decrease intestinal activity and present effective anthelmintic effect (against intestinal parasites). They also have a regulating effect of glucose absorption from food, antipyretic effect (helps to reduce fever) and, last but not least, diuretic and increase immune system. Since plants contain several classes and types of antioxidants, knowledge of the total antioxidant capacity, which is the cumulative capacity of food components to eliminate free radicals, could be useful for epidemiological purposes, among others (Gey, 1998, Otakar Rop, 2009).

Since the '70s it was known that plums contain a wide range of antioxidants that reduce the mutagenic effects of free radicals and even cancer. Recently, British biologists have discovered that some anhydride (small amounts), including oxalic, may increase production of proteins protective against the development of genetic disorders. Antioxidants are very complex organic compounds that can kill viruses, foreign cells, even cancer cells, that are not recognized as being their own body. With these new remedies, the compounds in plum and plum skin especially, can significantly reduce the risk of malignant cells, reduce the onset of a tissue or organ cancerization (Takayuki Shibamoto *et al*., 2008).

Researchers at the University of Edinburgh believes that a daily intake, even modestly, of fresh plums, may decrease cancer risk with over 25%. The same British scientists have discovered that a diet of plums may have the effect of an antidepressant medication, antistress medicine, the advantage being the complete lack of toxicity of compounds in comparison with some new drugs. Equally important for brain vitality are especially action of selenium and magnesium content from the fruit pulp (www.whfoods.com).

MATERIAL AND METHOD

Plum varieties analyzed for potential antiradical were obtained from the Fruit Research Station, Miroslava, Iasi. Fruits were harvested at consumption maturity in period 20th of July – 9th of September 2010. Immediately after harvesting plums were put in dark plastic bags (after stones removal) and stored at -20°C until extract performance (no more than a week).

For the preparation of the plums extract, 50 g fruit were homogenized and extracted in 200 ml extraction solvent (ethanol: acetone: acetic acid in the ratio 70: 29: 1) for 1 h at 37°C. (Guorong Du *et al*, 2009, Lee, HS *et al* 1991). The extract obtained was filtered through Whatman paper no. 41 and then rinsed with 50 ml extraction solvent (ethanol: acetone: acetic acid in the ratio 70: 29: 1). The extraction residue was repeated under the same conditions. The two filtrates were combined and stored at -20°C until use.

Antiradical activity was determined by DPPH method proposed by Brand-Williams *et.al*., 1995. Absorbance was recorded at 517 nm. The antioxidant activity was calculated as µmole Trolox equivalent (TE) / 100 g fresh weight with Trolox calibration curve.

Total phenolic compounds in plum extracts were determined with the Folin-Ciocalteau method. Absorbance was read at 750 nm, and the results were expressed as mg gallic acid per 100 g fresh fruit.

Anthocyanin quantification was performed by the pH-differential method. The extracts were diluted in a pH 0.68 and in a pH 3.5 solution. Absorbance was measured at 520 and 700 nm. Results were expressed as mg per 100 g fresh fruit.

Tests were performed in triplicate for each sample. All results were expressed as mean values ± standard deviation. Statistical correlations were calculated using Microsoft Office Excel.

The aim of this study was the determination of antiradical potential of certain varieties of plums, as well the total phenols and anthocyanins content and the relationship between these compounds and antiradical potential.

RESULTS AND DISCUSSIONS

Antioxidants from plum are important compounds and antioxidant activity of these fruits is largely due to phenolic compounds and less to vitamin C and carotenoids (Gil *et al*., 2002).

In this study, the DPPH method was used to determine the antiradical potential of plum extracts. Spectrophotometric measurements were made with the AnalitikJena SPECORD 200 spectrometer.

Spectrophotometric method for assessing total antioxidant activity using the DPPH stable free radical generating system, involves measuring the decrease in absorbance at wavelength 517 nm (DPPH maximum absorption), which is proportional to the concentration of free radicals reduced from solution. In this method, antioxidants are able to reduce the stable radical DPPH to the yellow compound (Beyhan Ömer *et al.*, 2010). With the disappearance of DPPH radical, due to neutralization of the unpeard electron, takes place also the visual change of color from purple to yellow (completely stable).

Results for antiradical activity of the 15 varieties of plums are presented in Table 1. Among the varieties studied were noted Silvia, Tuleu gras and Minerva as having high antiradical activity. Varieties with low antiradical activity were BN 68 (plum rootstock) and Dâmboviţa.

Total phenol content ranged from 87.45 mg GAE/100 g of fresh fruit registered at BN 68 variety to 489.23 mg GAE/100 g fresh, registered to the Record variety.

Regarding the fact that all cultivars were grown under identical conditions and in the same locality, it is possible to conclude that one can clearly see the varietal variability, which is quite typical of plums (Kim *et al*, 2003).

Table 1

Antiradical activity (DPPH), phenolics and anthocyanins content of plum extracts

Variety	Phenolic compounds (mg GAE/100 g fresh weight)	Anthocyanins content (mg/100 g fresh weight)	Antiradical activity (μM Trolox/100 g fresh weight)
Record	489,23 ± 0,13	143,99 ± 0,77	91,73 ± 0,75
Blue free	359,22 ± 4.06	117,48 ± 2,71	87,39 ± 0,43
Minerva	290,64 ± 0,18	43,85 ± 2,36	104,27 ± 1,05
Stanley	348,03 ± 0,83	77,58 ± 0,77	92,52 ± 0,84
Carpatin	225,85 ± 0,35	38,45 ± 3,09	83,42 ± 0,67
Dâmboviţa	93,77 ± 0,08	349,99 ± 10,04	96,45 ± 1,11
Superb	166,10 ± 0,08	34,33 ± 1,34	91,49 ± 1,89
Ialomiţa	213,99 ± 0,08	79,64 ± 1,61	92,92 ± 2,07
D agen	285,28 ± 0,14	18,62 ± 0,89	83,72 ± 1,82
BN 68	87,45 ± 0,09	40,76 ± 2,48	88,60 ± 1,55
Centenar	216,28 ± 0,47	51,83 ± 3,22	96,22 ± 1,13
BN 7-237-7	168,91 ±0,11	44,63 ± 2,71	92,96 ± 0,83
Joris plum	409,75 ± 0,08	328,06 ± 3,48	91,85 ± 0,9
Silvia	154,04 ± 0,11	85,81 ± 5,02	125,14 ± 2,36
Tuleu gras	188,48 ± 0,14	34,84 ± 3,89	109,71 ± 1,25

In the 15 plums varieties, the anthocyanins content ranged between 18.62 to 349.99 mg/100 g fresh fruit. Anthocyanins and other phenolic compounds are responsible for many health benefits (Cevallos-Casals B., 2006). Regarding the anthocyanins content of the plum studied, Dâmboviţa (349.99 mg/100 g fresh fruit) and Joris plum (328.06 mg/100 g fresh fruit) varieties showed the highest values followed by Record and Blue free, Silvia varieties.

A good correlation was obtained between antiradical capacity and total phenol content but also with the anthocyanins content, suggesting that these compounds contribute in a large extent to the antioxidant activity of the plum.

As can be seen from figure 1, there was found a good correlation between antiradical activity determined by DPPH method, and total phenolic content of plums ($R^2 = 0.879$). The level of antioxidant activity found in plums exceed the level found in blueberries and it is significantly correlated with total phenol content (Cevallos B., 2002).

Correlation obtained between antiradical activity and anthocyanin content of plum ($R^2 = 0.911$) was much higher than that of the antiradical capacity and total phenolic content (fig. 2). Anthocyanins are a widespread group of plant compounds that are responsible for their color (Usenik V., 2009).

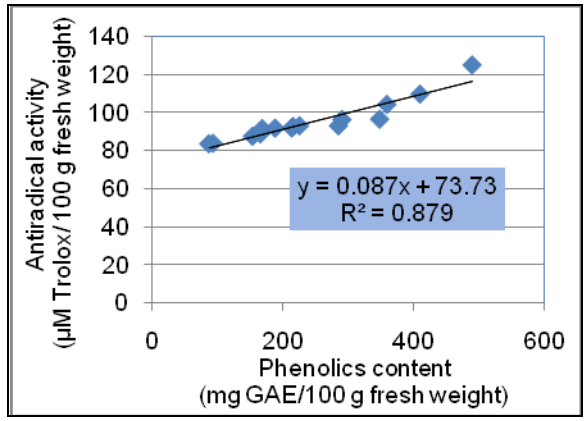

Fig. 1 – Correlation between antiradical activity and phenolics content of plum extracts.

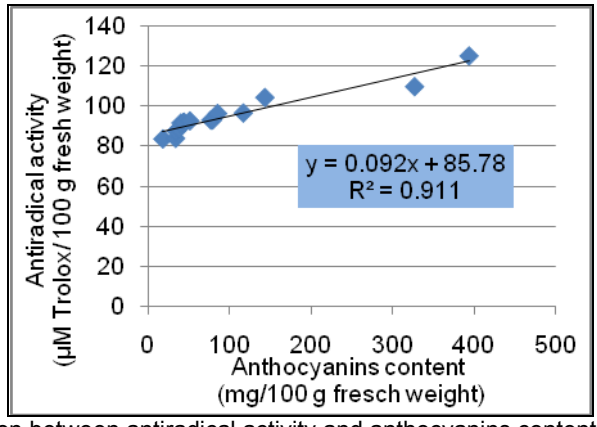

Fig. 2 - Correlation between antiradical activity and anthocyanins content of plum extracts.

CONCLUSIONS

1. The main objective of this study was to highlight the antioxidant properties of some plums varieties from Iasi region.

2. Antiradical potential of plums studied was determined by DPPH method, and Trolox was used as standard antioxidant.

3. There was a high variability of varieties in terms of total phenols and anthocyanin content. In terms of total phenol content was found that Record and Joris plum varieties have more than 400 mg galic acid /100 g fresh fruit. The highest anthocyanin content was displayed by Dâmboviţa and Joris plum varieties (349.99 and 328.06 mg/100 g fresh fruit), other varieties recorded values below 150 mg/100 g fresh fruit.

4. It was found a good correlation between antiradical activity and total phenol content, but also between antiradical activity and anthocyanins content (R^2 = 0.879, R^2 = 0.911). Total phenolic compounds and anthocyanins are major contributors of plum antiradical activity. Silvia, Tuleu gras and Minerva high antiradical activity, was primarily due to the content of phenolic compounds and

other compounds, while at the Dâmboviţa variety the anthocyanin content contribute to the antiradical activity.

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