EVALUATION OF THE ANTITOXIC POTENTIAL OF SOME QUERCETOL CONTAINING VEGETAL PRODUCTS

TESTAREA ACŢIUNII ANTITOXICE A UNOR PRODUSE VEGETALE BOGATE ÎN CVERCETOL

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Abstract. *Acrylamide, chemical compound with a structure containing two unsaturated centers, represents the result of thermally processed foods rich in amino acids and reducing sugars. By the means if glycidamide, its epoxidic metabolite, acrylamide exerts toxic effects as neurotoxicity, carcinogenity, embriotoxicity, and reproductive toxicity. The present experiment aims to establish a way of diminishing the toxic effects of acrylamide by the means of a flavone derivative. Quercetol, a flavonol remarkable by its antiradicalic effect, is found in high concentrations in fruits and vegetables as cabbage, parsley, onion, soy, blueberries. This flavone derivative exerts its antiradicalic potential in sinergy with glutathione, ascorbic acid (vitamin C) and vitamin E, with which it forms efficient redox systems. The experiment related in this paper analyses the antioxidative potential of quercetol from a phytopreparation obtained from the fruits of Vaccinium myrtillus. The evaluation of the antiradicalic activity of quercetol was established by the means of biochemical parameters that give indications upon the oxidative stress. The results are positive, confirming the antioxidant potential of the phytopreparation obtained from Vaccinium myrtillus.*

Key words: acrylamide, quercetol, Myrtilli fructus, catalase (CAT)

Rezumat. *Acrilamida, un compus chimic ce posedă două centre de nesaturare în mica sa structură, reprezintă produsul prelucrării termice a alimentelor bogate în aminoacizi. Prin metabolitul său epoxidic, glicidamida, amida acidului acrilic exercită efecte dintre cele mai toxice: neurotoxicitate, carcinogenicitate, embriotoxicitate şi efecte toxice asupra reproducerii. Experimentul prezent încearcă să diminueze efectele toxice ale acrilamidei prin intermediul unui derivat flavonic. Cvercetolul, un flavonol ce se remarcă printr-o puternică acţiune antiradicalară, se găseşte în concentraţii semnificative în legume şi fructe (varză, pătrunjel, ceapă, soia, afine etc). Acest derivat flavonic îşi manifestă potenţialul antiradicalar sinergic cu glutationul, acidul ascorbic (vitamina C) si vitamina E cu care formeaza sisteme redox eficiente. Experimentul relatat în această lucrare monitorizează potenţialul antioxidant al cvercetolului dintr-un fitopreparat obţinut din fructele de Vaccinium myrtillus. Evaluarea care a condus la evidente rezultate pozitive s-a efectuat prin intermediul unor parametri biochimici cu valoare de indicatori ai stresului oxidativ.*

Cuvinte-cheie: acrilamidă, cvercetol, Myrtilli fructus, acid ascorbic (AA), catalază (CAT)

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INTRODUCTION

Acrylamide, compound with well-known multiple uses, is one of the most studied toxic substances at the beginning of the third milenium. Although many of its toxic effects had been known for a long time, acrylamide drew the attention of the medical world after high levels had been found in different food cathegories (Mottram, D. S, Wedzicha, B. L., Dodson, A. T., 2002;).

The present scientifical knowledge reveals the fact that acrylamide is the result of thermal processing of foods that contain amino acids and reducing sugars. The main generating source appears to be the Maillard reaction (Chuda, Y. et al., 2003). The researches regarding the toxicological profile of this substance emphasize its neurotoxicity, carcinogenicity, embriotoxicity etc. (Fennel, T. R., et al., 2003; Sumner, S. et al, 2003).

The high incidence of acrylamide in foods correlated with its toxic aggresiveness imposes the necessity of finding ways of reducing its toxicity and of preventing/limiting its formation in thermally processed foods. As acrylamide reveals its toxicity by the means of its epoxidic radical, a direction of research would be the decrease of its toxicity by the activity of vegetal antioxidants. Quercetol is a flavonol (fig. 1), that exerts antiradicalic activity by inhibiting the oxidation of some compounds from the membrane of erythrocytes and thrombocytes and also by inhibiting the synthesis of some pro-inflammatory prostaglandins and leukotrienes. Its antioxidant potential is emphasized by the presence of glutathione, vitamin C and vitamin E, with which it forms redox systems, with important role in oxidative stress. Furthermore, quercetol possesses the property of regenerating the tocopherols oxidated consequently to the atack of reactive oxygen species (ROS).

The source of quercetol is offered by vegetals as onion, parsley, cabbage etc. The concentration of 80 mg/Kg quercetol in the fruits of bilberry (*Myrtilli fructus*) represents an argument for the use of phytopreparations obtained from this vegetal product as antiradicalic weapon in the oxidative stress produced by the epoxidic metabolite of acrylamide.

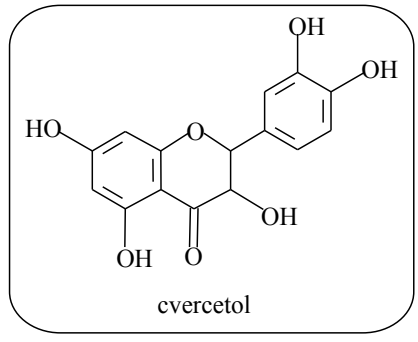

Fig. 1 - Structure of quercetol

MATERIAL AND METHOD

The experimental model (table 1) was concieved so as to emphasize the possible antiradicalic activity of quercetol from the fruits of *Vaccinium myrtillus*. The present experiment is part of a vast research that aimes to find ways of reducing the toxicity of some alimentary noxes (mycotoxins, benzopyrenes, acrylamide, nitrites, nitrosamines, pesticides etc.) (Burlacu et al., 2007, Prisacaru C. et al., 2008, Prisacaru C. et al., 2009, Prisacaru C., 2010).

The experiment comprises 4 groups of 5 Wistar rats each, having a mean weight of 195.2 g. The first group (the reference group) was maintained and fed in standard conditions. The second group represents the control group for the acrylamide intoxication and offers information regarding the ampleness of the oxidative stress provoked by the ingestion of an oral soution of acrylamide, in doses of 20 µg/Kg bw. The animals of the third group received, along with the acrylamide dose, an hydroalcoholic extract of *Myrtilli fructus* (XV drops per day). The biochemical results obtained from this group of animals test the antioxidant activity of quercetol and other active principles with antiradicalic effect from *Vaccinium myrtillus.* Due to the fact that the antioxidant effect of quercetol is increased by the presence of ascorbic acid along with which it forms an efficient redox system, the role of this redox system has been evaluated by the means of ascorbic acid intake. In this direction, the animals of the fourth group received, along with the protection of bilberry extract, XV drops of ascorbic acid, 5% aqueous solution.

The experiment was unfolded on a period of 6 weeks. In the end, blood samples were collected in order to evaluate the biochemical parameters relevant for the oxidative stress: catalase (CAT), superoxid dismutase (SOD), gluathione peroxidase (G-Px) and free sulfhydryl groups.

Table 1

Experimental model

Groups	ACR [µg/Kg bw]	*Myrtilli fructus* (Hydroalc. sol. 3,5%)	*Myrtilli fructus* (Hydroalc. sol. 3,5%) + AA	Biochemical parameters
Reference group	-	-	-	CAT, SOD, G-Px, -SH
Control group	20	-	-	
Experimental group 1	20	XV guttes	-	
Experimental group 2	20	-	XV guttes	

Legend: ACR = acrylamide; AA= ascorbic acid (5% aqueous solution); CAT = catalase; SOD = superoxide dismutase; G-Px = glutathione peroxidase; -SH = free sulfhydryl groups.

RESULTS AND DISCUSSIONS

The evolution of catalase (table 2) emphasizes a marked decrease of its activity for the animals of the control group, that may be the consequence of its consumption by the neutralisation of the epoxidic radical of acrylamide. The value for the activity of this enzyme is 380.09 U/L compared to 475.79 U/L, the

value for the reference group. Regarding the evolution of catalase for the groups protected with hydroalcoholic extracts of *Myrtilli fructus* there can be noticed an improvement of the enzyme activity, improvement that becomes more significant for the group that was additionally given the ascorbic acid.

Table 2

The evolution of catalase

CATALASE (U/L)			
	minimum	Mean	MAXIMUM
Reference group	389.50	475.79	490.50
Control group	339.70	380.09	431.00
Experimental group 1	399.50	419.00	451.10
Experimental group 2	385.00	432.12	495.15

The variation of superoxid dismutase (table 3) follows a similar evolution to that of catalase, with which it forms a redox system. Therefore, the value of SOD decreases from 444.34 U/L (value obtained for the reference group) to 368.66 U/L (value characteristic to the acrylamide intoxicated group). The improvement of the SOD activity takes place in groups treated with hydroalcoholic extract of *Vaccinium myrtillus*. The additional intake of ascorbic acid reveals the positive role of this valuable antioxidant that increases the activity of SOD to a value (445.6 U/L) that goes beyond the value of the reference group (444.34 U/L).

Table 3

The evolution of superoxide dismutase

SUPEROXIDE DISMUTASE (U/L)			
	minimum	Mean	MAXIMUM
Reference group	338.00	444.34	480.12
Control group	300.10	368.66	400.20
Experimental group 1	400.40	438.30	469.00
Experimental group 2	311.00	445.60	491.00

The third biochemical parameter, glutathione peroxidase (table 4) varies almost identically to catalase, revealing increases and decreases corresponding to the same groups. Therefore, the value of the enzyme increases with 16 U/L for the group exposed to the acrylamide subacute intoxication (the control group) compared to the reference group. As in the case of catalase, the activity of G-Px improves for the groups protected with hydroalcoholic extract of *Myrtilli fructus,* mainly for the experimental group 2 that takes benefit of additional ascorbic acid protection.

Table 4

The evolution of glutathione peroxidase

GLUTATHIONE PEROXIDASE (U/L)			
	minimum	Mean	MAXIMUM
Reference group	55.20	86.96	88.19
Control group	66.30	70.22	79.50
Experimental group 1	75.50	77.70	89.50
Experimental group 2	75.12	82.20	86.00

The quantification of free sulfhydryl groups (table 5) led to results that confirm the existence of a certain antiradicalic potential of quercetol from *Vaccinium myrtillus*. The most convincing value belongs to experimental group 1, and not to experimental group 2, as happened in the case of the first three oxidative stress parameters.

Table 5

The concentration of free sulfhydryl groups

FREE SULFHYDRYL GROUPS (µmol/mL)			
	minimum	Mean	MAXIMUM
Reference group	322.00	441.60	461.00
Control group	299.50	303.16	315.00
Experimental group 1	317.00	408.16	488.00
Experimental group 2	303.00	387.66	412.00

CONCLUSIONS

1. The evolution of the four oxidative stress parameters confirms the antiradicalic effect of quercetol and other active principles from *Vaccinium myrtillus*;

2. The variation of catalase, superoxid dismutase and glutathione peroxidase emphasize the fact that the most significant antioxidant potential belongs to the quercetol-exogen ascorbic acid association;

3. The quantification of free sulfhydryl groups leads to results that sustain that the most efficient antioxidant potential is hold by the phytopreparate from *Myrtlli fructus.*

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