STUDY REGARDING THE ANTIOXIDANT AND RADICAL SCAVENGING ACTIVITY OF ROMANIAN WINE FETEASCĂ NEAGRĂ COMPARED TO MERLOT

STUDII PRIVIND ACTIVITATEA ANTIRADICALICĂ ŞI ANTIOXIDANTĂ A VINULUI AUTOHTON FETEASCĂ NEAGRĂ COMPARATIV CU MERLOT

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Abstract. *The radical scavenging activity of wines was evaluated by their capacity of neutralising a radicals solution with a known concentration. The 2,2-diphenyl-1-picrylhydrazyl radical method (DPPH) was used to determine the total radical scavenging activity, while the Photochem method was used to determine only the antioxidant activity – superoxide scavenging activity. The material studied was represented by two red wines obtained by four wine-making methods: the Merlot wine with which we compared the values obtained for the Feteasca neagră local wine. This study adjoins other studies that sustain the qualitative potential of the Romanian wine Feteasca neagră and contribute to the outlining of its good image among the international ones, on the national and international wine market.*

Key words: Fetească neagră, Merlot, antioxidant, PCL, DPPH

Rezumat. *Acţiunea antiradicalică a vinurilor a fost evaluată prin capacitatea acestora de a inhiba radicalii liberi dintr-o soluţie de radicali de concentraţie cunoscută. Am utilizat metoda radicalului 2,2 difenil-1-picril-hidrazil (DPPH) pentru determinarea acţiunii antiradicalice totale şi metoda photochemilunicescenţei pentru a evidenţia doar actiunea antioxidantă - capacitatea de a bloca superoxizii. Materialul de lucru a fost reprezentat de două vinuri roşii obţinute prin patru variante tehnologice: Merlot, un vin internaţional, cu care am comparat potenţialul antiradicalic al vinului autohton Fetească neagră. Acest studiu se alătură altor studii ce susţin potentialul calitativ ridicat al vinului autohton Fetească neagră şi contribuie la imaginea favorabilă a acestuia, atât pe piaţa naţionala, cât şi internaţională a vinurilor, alături de cele mai cunoscute vinuri din lume.*

Cuvinte cheie: Fetească neagră, Merlot, antioxidant, PCL, DPPH

INTRODUCTION

The red wines are well-known for their benefic effects on the human organism, in a moderate consumption, due, first of all, to its specific content in phenolic compounds which scavenge the radical activity.

The free radicals have harmful effects at cellular and tissue level, being responsible of a whole series of diseases (Olinescu, 1994).

The international research laboratories tried to explain the *French paradox* (de Gaulejac Nathalie Vivas, 2001), which consists in a high consumption of fatty foods associated with a low cardiovascular diseases' risk due to red wines moderate consumption.

These wines, like other food products from the Mediterranean countries (olive oil, natural juice and vegetables), that compose the *Mediterranean diet*, contribute in the decrease of fats in the circulatory system leading to the maintaining of health state.

The wine phenols have a great structural diversity, from a small molecule to polymers. They are extracted from grapes by enzymatic processes and chemical reactions in the wine making processes (Pomohaci, 1994).

MATERIAL AND METHOD

The studied material was represented by two grape varieties that were processed into wines in four technological variants: Merlot, an international variety well known for its potential of producing high quality wines and Fetească neagră, a Romanian variety with a high potential, too. The used technological variants of maceration and fermentation are: classical maceration, ROTO-tanks maceration, thermo-maceration, microwaves maceration, ultrasounds and cryomaceration.

The classical variant was considered as a control sample to which the other variants had been compared. For the ROTO-tanks maceration method, the standard wine making process was used. The ultrasounds maceration process had destemed grapes which were submitted to a 35 kHz frequency during 10 minutes, while for the microwave variants the grapes were submitted to 15 minutes at 650 W. The thermo-maceration was made by heating the grapes at a temperature of 60^0C and the cryomaceration was obtained by freezing the berries at -30^0C.

The international literature mentions technology's influence on the phenolic compounds extractions, these compounds having a direct proportional influence on the antiradical and antioxidant potential (Baiano *et al*., 2003). The phenolic compounds content was calculated with the total polyphenolic index (TPI) and the anthocyans content was obtained by using the pH variation (*Recueil de l'OIV, 2008)*.

The radical scavenging activity of food, pharmaceutical and cosmetically products can be determined by different spectophotometrical methods. For this comparative study, the radical DPPH (2,2 difenyl-1-picryl-hidrazyl) method and the photochemiluminescence method were used. These methods quantify the wines radical scavenging activity potential from a known concentration solution.

The DPPH radical method, proposed by Brand-Williams (1995) is used for determining the total antiradical activity (ARA) of different solutions. The DPPH radical absorbs at 515 nm, but his absorbance decreases under the influence of antiradical compounds, like the phenolic compouds.

The absorbance decreases until it reaches a plateau level that represents the radical consumption from the methanol solution (the DPPH is soluble in alcohol). For the wine antiradical activity determination is necessary a dilution for reducing the initial concentration of DPPH at 50 % - the effective dilution ED50 (Brand-Williams *et al*, 1995).

These determinations were realised using the spectophotometer UV VIS Analitic Jena 200.

In the photochemiluninescence method the free radicals (superoxide anion radicals) are being produced by optical excitation (irradiation) of a photosensitizer

(dye) substance. These radicals are partially eliminated from the sample by reaction with the antioxidants present in sample. In the measuring cell the remaining radicals cause the detector substance luminol to emit luminescence and thereby the antioxidant capacity of the sample is determined.

The antioxidative capacity (AOA) of the sample is quantified by comparison with the standard (constructing a calibration curve with ascorbic acid) and is given in equivalent units of standard (Popov, Lewin, 1999). This method is much rapid, it takes 1-3 minutes by sample in comparison with the DPPH one, that often reach at 5 hours by sample. For these determination was used the Photochem Analytik Jena AG device.

RESULTS AND DISCUSSIONS

The tables 1 and 2 present the results obtained with the total phenolic compounds analysis (D280 index, g/L gallic acid), radical scavenging activity (EC 50) and antioxidant activity (AO, g/L ascorbic acid) of the Merlot and Fetească neagră wines. Both these wins were processed in four different maceration fermentation variants.

Table 1

The phenolic compounds and the antiradical and antioxidant indexes for the Merlot wine in the four technological variants

No.	MERLOT	Antiradical activity - ARA (EC 50)		Antioxidant activity (AOA)	TPI
	Maceration fermentation technology	concentration	*dilution*	g/L ascorbic acid	g/L galic acid
1	Classical maceration	0,0029	*1/345*	1,011	49,879
2	ROTO-tanks	0,0013	***1/769***	**1,139**	**52,620**
3	Microwaves	0,0029	*1/344*	0,726	36,986
4	Ultrasounds	0,006	*1/166*	0,353	19,075

For both wines, Merlot and Fetească neagră, a maximum extraction of the phenolic compounds was observed for the ROTO-tanks maceration -fermentation variants (65 g/L and 53 g/L gallic acid).

The minimum values were obtained with the ultrasounds variants: 19 g/L and 31 g/L.

The maximal values of the antiradical activity, expressed by the dilutions necessary to reduce by 50 % the concentration of DPPH radical were also obtained at the ROTO-tanks variant: 1/769 for Merlot and 1/526 for Fetească neagră. The results show that these wines can be classified with a high antiradical activity, with healthy effects on the human organism, but only in a moderate consumption case.

Table 2

The phenolic compounds and the antiradical and antioxidant indexes for the Fetească neagră the four technological variants

No.	FETEASCĂ NEAGRĂ Maceration fermentation technology	Antiradical activity - ARA (EC 50)		Antioxidant activity (AOA)	TPI
		concentration	*dilution*	g/L ascorbic acid	g/L galic acid
1	Classical maceration	0,0036	*1/277*	0,968	38,164
2	ROTO-tanks	0,0019	***1/526***	**1,125**	**64,746**
3	Microwaves	0,0038	*1/263*	0,849	37,422
4	Ultrasounds	0,004	*1/247*	0,781	30,830

The evaluation of different wines made by the authors of the method (Brand-Williams, *et al.*, 1995) gave values between 1/380 (minimum) and 1/620 (maximum).

Antioxidant activity of our wines has the same curve in as regards to the technologies variants: the maximum values for the ROTO-tanks variants are 1,139 g/L for Merlot and 1,125 g/L for Fetească neagră, the minimum values being 0,353 g/L for Merlot and 0,781 g/L for Fetească neagră.

The correlation between antiradical activity and the phenolic content shows a direct influence of the phenolic compounds on the antiradical activity (figure 1 and 2).

The influence is obvious on the antioxidant activity (figure 3 and 4).

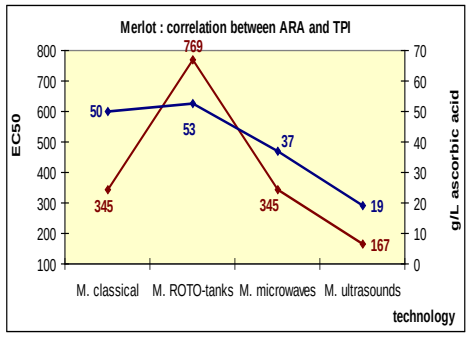

Fig. 1. Correlation between ARA and TPI for the 4 Merlot variants wines

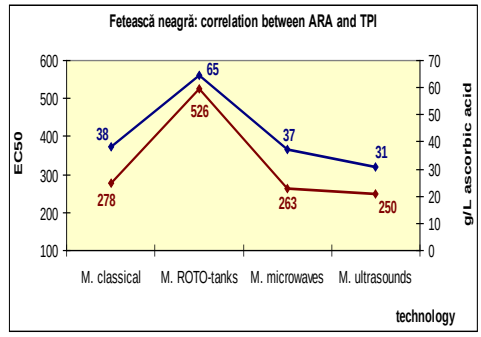

Fig. 2. Correlation between ARA and TPI for the 4 Fetească neagră variants wines

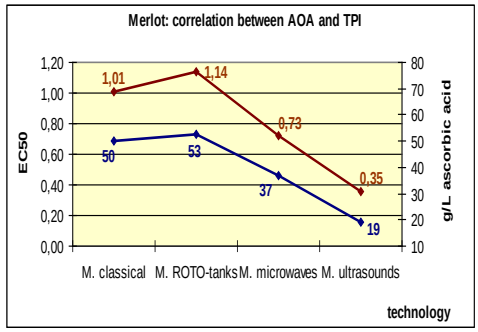

Fig. 3. Correlation between AOA and TPI for the 4 Merlot variants wines

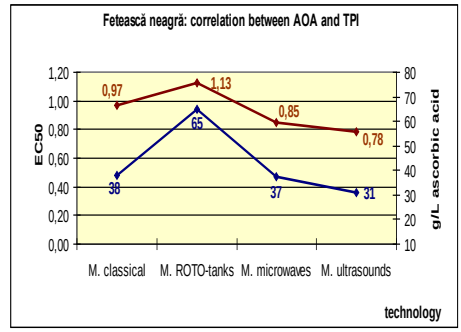

Fig. 4. Correlation between AOA and TPI for the 4 Fetească neagră variants wines

The minimal values for al indexes were obtained at the ultrasounds maceration technology, which was the least extractive variant (19,075 g/L phenolic compounds and 30,830 g/L gallic acid). So the most efficient technologies, for both wine varieties are the ROTO-tanks, followed by classical maceration.

The ultrasound and microwaves variants have intermediated values: in the case of Merlot there is a big difference between these two, while in the case of Fetească neagră wine the two variants results are very close (almost the same).

The antioxidant and radical scavenging activity values are high for the Fetească neagră ROTO-tanks obtained wine (1,125 g/L ascorbic acid; EC50 = 1/526) and very high for the Merlot (1,139 g/L ascorbic acid; EC50 = 1/781). From these results one can easily deduces the health effects that these wines can have in a moderate consumption; *in vivo* effects will be studied in a next project.

CONCLUSIONS

The results of this study on the two red wines underline a direct correlation between the content of phenolic compounds and their antioxidant and antiradical activity: the wines with the highest content in phenols also have the higher antioxidant and antiradical activity.

In both cases, Merlot and Fetească neagră, the most efficient technological variant is the ROTO-tanks one: it determines the highest content in phenolic compounds. Comparing the antiradical activity of Fetească neagră and Merlot wines, as well as with other data from international studies, the high antiradicalic potential of the Fetească neagră Romanian wine is demonstrated and thus recommended for a moderate consumption, for his health effects on the human body.

Alongside with others studies, this one underlines the high potential of obtaining qualitative wines from the Romanian Fetească neagră variety of grape. The quality of the local grape variety promotes it to the best wines of the world class.

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