Archives of the
International Society of Antioxidants in Nutrition and Health (ISANH)

Vol. 5, Issue 2, 2017
DOI: 10.18143/AISANH_v5i2_1
Extended abstract of Vienna Polyphenols 2017

Comparison of polyphenols composition between red and white wines of some native Campania region grape varieties

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Abstract

In this work, we have determined and compared polyphenols and elements compositions of four wines obtained from native Campania region white grape varieties (Greco di Tufo, n = 32; Fiano di Avellino, n = 35) and red grape varieties (Taurasi, n = 15; Irpinia Aglianico, n = 10). The obtained results point to a higher content of resveratrol in red wines than in white ones and ~~a~~ higher levels of other healthy polyphenols, such as coumaric, ferulic and caffeic acid in white wines.

Introduction

Recently, the interest on wine consumption effects is increased also considering the finding that different clinical trials revealed that lifestyle and healthy diet, including moderate wine consumption, is associated to reduced cardiovascular diseases, diabetes, and neurodegenerative disorders risk (Estruch *et al.*, 2013; Artero *et al.*, 2015). Since the 1990s, the specific advantage of wine consumption has been explained by data demonstrating that particularly red wine, contains some healthy compounds, such as trans-resveratrol and other polyphenols. The proportion in the content of these compounds depends on the grape variety, the growing region, the production method and the aging process (Cueva *et al.*, 2017; Muccillo *et al.*, 2014). The wines contain many essential elements which, beside the health benefits, affects wine organoleptic properties. In addition, the wine also contains non-

Received: September 23, 2017; Accepted: December 11, 2017 -

essential elements that may be toxic in the event of their excessive intake.

The content of metals in wine also varies widely depending on where the vine is planted and wine producers should have more knowledge about possible sources of metals. To prevent damage to health, measures must be taken to avoid the ingestion of potentially toxic elements or high amounts of essential metals. Therefore, it is necessary to check the levels of these elements in the wines (Tariba, 2011).

Herein, we reported the analysis of polyphenols and element profiles of several wines, contained in different bottles of white and red wine, produced in different areas of Campania.

Materials and methods

Reagents and standard solutions

All the reagents were of analytical grade. The analytical HPLC solvent, ethyl acetate, was from JT Baker (Deventer, Netherlands). The fisetin was purchased from Sigma (St. Louis, MO, USA). Standard solutions of elements were from Ultrascientific (North Kingstown, USA). Purified water was prepared with Milli-Q Reagent Water System (Millipore Corporation, Bedford, MA, USA).

Samples

The following wines from native Campania region grapes varieties were analysed: Greco di Tufo (n = 32), Fiano di Avellino (n = 35), Taurasi (n = 15) and Irpinia Aglianico (n = 10).

Methods

Polyphenols were extracted from 5 mL of each wine sample (n = 92) by ethyl acetate and analyzed by gas chromatography coupled with mass spectrometry (GC-MS) in SIM mode. The polyphenols were separated by ZB-5HT column (Phenomenex; 15 m, 0.25 mm, 0.10 μm). The initial temperature of the oven was 80°C for 1 min; it was then increased to 250°C with a rate of 10°C/min and maintained for 1 min. Successively the oven temperature was increased to 300°C with a rate of 10°C/min and maintained for 2 min. Finally, it was increased to 320 °C with a rate of 20 °C/min and maintained for 3 min. The total run time was of 31 min. Quantitative analysis of polyphenols was performed by using fisetin as internal standard.

The determination of elements was performed by inductively coupled plasma-quadrupole mass spectrometry (ICP-QMS; 820-MS, Bruker Daltonics, Billerica, MA). All chemicals were of the highest commercially available purity grade. Calibration solutions were prepared from standard stock solutions of 20.00 mg/L. Calibration curves were obtained using 6 calibration solutions. Reagent blanks containing ultra-pure water were additionally analyzed in order to control reagents purity and laboratory equipment. Standards and blanks were subjected to the same treatment as the samples. Determination was performed using a mix solution of internal standard (6Li, 45Sc, 72Ge, 89Y, 103Rh, 159Tb, 165Ho, 209Bi) 10 μg/L on-line aspired with a T union with the sample and standard solution. The following isotopes were analyzed: ^{52}Cr, ^{55}Mn, ^{57}Fe, ^{59}Co, ^{65}Cu, ^{66}Zn, ^{78}Se.

Results and discussion

GC-MS analysis of polyphenols content of the white wines (Table 1) showed that the percentage of resveratrol and quercetin was at least 5-fold lower than the other found polyphenols.

Viceversa, the corresponding analysis in the red wines (Table 2) indicated that the content of resveratrol was higher than that of white wines.

From the comparison of polyphenols content between white and red wines, it emerged that the cis- and trans resveratrol content is 4.5-fold higher in red wines, with a preference of trans-resveratrol whose content was 6.7-fold higher in red wines. On the other hand, polyphenols, such as coumaric, ferulic and caffeic acid were present at percentages on average higher in white wines than in red wines. In particular, the percentage of caffeic acid was about 3-fold higher in Greco di Tufo compared to Taurasi ($p < 0.05$).

Received: September 23, 2017; Accepted: December 11, 2017 -

Table 1. Polyphenol profiles in two native Campania region white wines grape varieties

Polyphenol	Grape variety	
(%)	Fiano di Avellino	Greco di tufo
Vanillic acid	3.58 ± 2.31	3.30 ± 1.51
Gentisic acid	5.84 ± 2.75	5.29 ± 2.52
Coumaric acid	14.85 ± 9.67	13.39 ± 7.22
Gallic acid	24.65 ± 16.08	26.50 ± 13.51
Ferulic acid	5.67 ± 3.26	3.83 ± 2.06
Caffeic acid	29.90 ± 19.69	35.33 ± 13.43
cis-resveratrol	0.68 ± 1.20	0.42 ± 0.54
trans-resveratrol	0.52 ± 0.61	0.40 ± 0.42
Quercetin	0.02 ± 0.02	0.02 ± 0.03

Table 2. Polyphenol profiles in two native Campania region red wines grape varieties

Polyphenol	Grape variety	
(%)	Taurasi	Aglianico
Vanillic acid	5.44 ± 2.15	7.12 ± 2.91
Gentisic acid	3.23 ± 1.49	4.07 ± 2.01
Coumaric acid	4.32 ± 1.22	5.57 ± 2.96
Gallic acid	24.47 ± 9.29	17.44 ± 10.06
Ferulic acid	0.61 ± 0.34	0.91 ± 0.93
Caffeic acid	14.34 ± 8.18	12.02 ± 5.40
cis-resveratrol	1.35 ± 1.63	1.43 ± 1.77
trans-resveratrol	3.15 ± 2.82	3.03 ± 2.73
Quercetin	0.04 ± 0.03	0.04 ± 0.04

According with the literature (Muccillo *et al.*, 2014), we have found that the red wines, Aglianico and Taurasi, contain higher trans-resveratrol levels compared to white wines, Fiano and Greco. However, these white wines contain higher levels of other healthy polyphenols, such as coumaric, ferulic and caffeic acid.

On the other hand, the differences between some of our findings compared to those reported in literature depend not only on the genetic differences of the grape cultivars, but also on the environmental context in which they are planted. In fact, the analysis of polyphenol profiles in wine is important to determine not only the quality of the grapes but also to differentiate their origin (Guerrero *et al.*, 2009).

We have also determind the element contents in the four wine varieties that are reported in Table 3 and 4 for white and red wines, respectively.

Table 3. Element levels in two native Campania region white wines grape varieties

Element	Grape variety	
	Fiano di Avellino	Greco di tufo
Cr (μg/L)	97.65 ± 17.67	95.65 ± 23.75
Mn (mg/L)	2.43 ± 1.35	2.28 ± 1.40
Fe (mg/L)	5.96 ± 11.52	3.88 ± 4.88
Co (μg/L)	13.91 ± 14.14	10.73 ± 5.37
Cu (mg/L)	0.53 ± 0.65	0.81 ± 1.23
Zn (mg/L)	1.60 ± 1.05	1.27 ± 0.64
Se (μg/L)	16.57 ± 10.59	17.22 ± 13.32

Table 4. Element levels in two native Campania region red wines grape varieties

Element	Grape variety	
	Fiano di Avellino	Greco di tufo
Cr (μg/L)	98.38 ± 13.25	103.3 ± 19.5
Mn (mg/L)	2.19 ± 1.28	3.01 ± 1.75
Fe (mg/L)	2.71 ± 1.31	5.22 ± 4.63
Co (μg/L)	9.69 ± 5.74	13.56 ± 11.20
Cu (mg/L)	0.58 ± 0.34	0.71 ± 0.67
Zn (mg/L)	1.32 ± 0.64	2.11 ± 0.99
Se (μg/L)	15.45 ± 8.59	24.87 ± 14.54

Received: September 23, 2017; Accepted: December 11, 2017 -

Among the analyzed elements no significant differences were found among the four wines. However, the element composition found for some of them, is different from that found in other Italian or other European countries varieties (Tariba, 2011). According to others, these differences may be due to different factors during wine production such as practices, genetic materials and manipulations. In fact, the protection of grape, must and wine and the use of inert materials lead to a significant reduction of toxic elements (Monaci *et al.*, 2003).

In conclusion, among the polyphenol-rich foods, all four wines here analyzed can also contribute to maintain the correct daily intake of essential elements and antioxidant compounds. Moreover, in agreement with others, the determination of polyphenol profiles in wines may be useful for the characterization and traceability of the vine and the corresponding wines.

Finally, the finding that a different element composition was found between the four wines investigated and that reported for other wines could be ascribed to the different location of cultivation rather than the grape varieties.

Acknowledgements

This work was supported by the University of Naples Parthenope "Bando per la ricerca individuale, annualità 2016" to MM, AR and DS.

References

Estruch R, Ros E, Salas-Salvadó J, Covas MI, Corella D, Arós F, Gómez-Gracia E, Ruiz-Gutiérrez V, Fiol M, Lapetra J, Lamuela-Raventos RM, Serra-Majem L, Pintó X, Basora J, Muñoz MA, Sorlí JV, Martínez JA, Martínez-González MA. 2013. Primary prevention of cardiovascular disease with a Mediterranean diet. N. Engl. J. Med. 368, 1279-1290

Artero A, Artero A, Tarín JJ, Cano A. 2015. The impact of moderate wine consumption on health. Maturitas 80, 3–13

Cueva C, Gil-Sánchez I, Ayuda-Durán B, González-Manzano S, González-Paramás AM, Santos-Buelga C, Bartolomé B, Moreno-Arribas MV. 2017. An Integrated View of the Effects of Wine Polyphenols and Their Relevant Metabolites on Gut and Host Health. Molecules 22, pii: E99

Muccillo L, Gambuti A, Frusciante L, Iorizzo M, Moio L, Raieta K, Rinaldi A, Colantuoni V, Aversano R. 2014. Biochemical features of native red wines and genetic diversity of the corresponding grape varieties from Campania region. Food Chem. 143, 506–513

Tariba B. 2011. Metals in wine-impact on wine quality and health outcomes. Biol. Trace Elem. Res. 144, 143-156

Guerrero R F, Liazid A, Palma M, Puertas B, Gonzalez-Barrio R, Gil-Izquierdo A, et al. 2009. Phenolic characterisation of red grapes autochthonous to Andalusia. Food Chemistry 112, 949–955

Monaci F, Bargagli R, Focardi S. 2003. Element concentrations in Chianti Classico appellation wines. J. Trace Elem. Med. Biol. 17 (suppl.1) 45-50

Received: September 23, 2017; Accepted: December 11, 2017 -

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