# VALORISATION OF NUTRACEUTICAL AND HEALTH-RELATED PROPERTIES OF WINE GRAPES OF EMILIA-ROMAGNA ITALIAN REGION•

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## 1. INTRODUCTION

Grape and wine are appreciated as core components of the Mediterranean dietary tradition not only as gourmet's specialities, but also because they are very rich in antioxidant compounds. Many epidemiological studies have documented wine protective effects against free radicals and degenerative disorders deriving from persistent oxidative stress. Evidence has supported the "French paradox phenomenon", that establishes a link between moderate wine consumption and the lower incidence of most common diseases (such as cardiovascular disorders and cancer). In contrast, grapes and wines may also contain large amounts of biogenic amines and polyamines which are present either naturally or as consequence of fermentation. These compounds are involved in pro-oncogenic and allergenic processes with high impact on human health.

The first aim of this study was to determine the nutraceutical or anti-nutraceutical features of the main wine-grapes produced in Emilia-Romagna, in order to investigate their potential effect on human health. A second aim was to relate the metabolite production to different vineyard management systems (traditional, organic and biodynamic).

## 2. MATERIALS AND METHODS

Samples of both white ('Albana' and 'Pignoletto') and coloured ('Lambrusco' and 'Sangiovese') grapes were harvested at ripeness. Daily-fresh berries were frozen, powdered in liquid nitrogen and stored to -80 °C before experimental use.

Spectrophotometric and chromatographic analyses were performed to determine the biochemical profile of red and white wine grapes. The following spectrophotometric methodologies (Righetti *et al*., 2008) were applied: Glories index, total anthocyanin content, total polyphenols determination (Folin-Ciocalteau method) and quantification of antioxidant activity (DPPH method).

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The most common biogenic amines, polyamines and polyphenols were detected by HPLC quantitative analyses following consolidated protocols and using a water/acetonitrile gradient to evaluate the content of amines (Tassoni *et al*., 2000) and an acidic water/acetonitrile gradient for phenolic compounds (Ferri *et al*., 2009).

## 3. RESULTS AND DISCUSSION

As expected, Glories index analysis showed a prevalent yellow colour contribution in white grapes, while in coloured grapes the red tones were predominant (tab. 1). Red grapes showed a $10^3$ higher amount of total anthocyanins respect to white berries, and in particular in 'Lambrusco' the levels were 2-fold higher than in 'Sangiovese'. Anthocyanins were more present in grapes cultivated following traditional methods compared to those grown with organic and biodynamic farming.

Tab. 1 - Analyses of wine-grapes of the Emilia-Romagna region grown following different vineyard management systems. White (Albana: A; Pignoletto: P) and coloured grapes (Lambrusco: L; Sangiovese: S). Management system: traditional (T); organic (O); biodynamic (B).

| | % Yellow | % Red | % Blue | Antho-cyanins | Total polyphenols | Antioxidant activity | Total amines |
|---|---|---|---|---|---|---|---|
| **PT** | 75.00 | 22.20 | 2.90 | 10.9 | 4.7 | 7.7 | 507.3 |
| **PO** | 82.90 | 14.40 | 2.80 | 6.2 | 4.3 | 7.2 | 430.1 |
| **PB** | 83.70 | 13.20 | 3.10 | 7.4 | 5.3 | 9.2 | 306.6 |
| **AT** | 69.60 | 25.70 | 4.70 | 7.8 | 4.7 | 7.4 | 467.1 |
| **AO** | 70.00 | 22.70 | 7.30 | 6.7 | 4.2 | 5.9 | 363.4 |
| **AB** | 68.50 | 25.60 | 5.90 | 8.3 | 5.0 | 7.8 | 668.8 |
| **LT** | 18.06 | 80.70 | 1.27 | 2.5 | 8.5 | 19.8 | 1581.9 |
| **LO** | 19.00 | 80.30 | 0.70 | 1.5 | 8.3 | 25.4 | 1376.6 |
| **LB** | 19.00 | 79.40 | 1.56 | 1.7 | 7.8 | 29.4 | 2054.0 |
| **ST** | 20.00 | 78.70 | 1.06 | 1.1 | 5.3 | 31.8 | 2608.5 |
| **SO** | 22.30 | 77.50 | 0.20 | 0.6 | 4.9 | 25.4 | 3069.2 |
| **SB** | 18.30 | 81.10 | 0.60 | 1.0 | 5.3 | 35.0 | 2496.6 |

The Glories index is expressed as yellow/red/blue percentages. The anthocyanin amount is expressed as malvidin-3-glucoside equivalents in μg $gFW^{-1}$ (white grapes) and in mg $gFW^{-1}$ (coloured grapes). The total polyphenol amount is expressed as gallic acid equivalents (mg $gFW^{-1}$). The total antioxidant activity is expressed as ascorbic acid equivalents (mg $gFW^{-1}$). The total amount of amines is expressed as nmol $gFW^{-1}$ (sum of spermine, spermidine, cadaverine, putrescine, 1,3-diaminopropane and tryptamine levels).

According to spectrophotometric results, total polyphenols and antioxidant activity were more relevant in coloured than in white berries. The antioxidant

capacity increased progressively from traditionally to organically and biodynamically-cultivated grapes (tab. 1).

After HPLC quantification, free biogenic amines and polyamines showed higher levels in coloured than in white berries (tab. 1). In both kinds of grapes, putrescine was mainly present, followed by spermidine and 1,3-diaminopropane (data not shown).

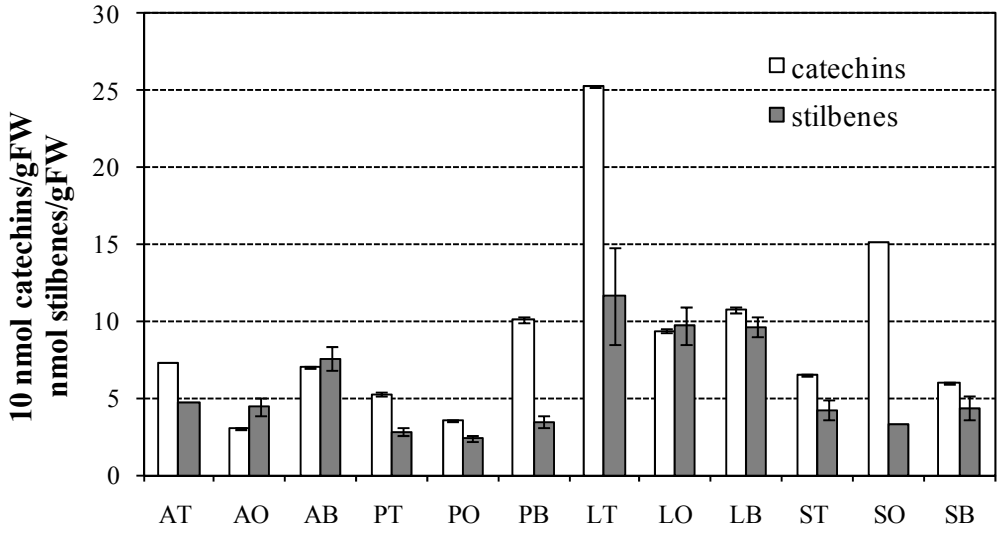


Fig. 1 - Quantification by HPLC-DAD of catechins and stilbenes**.**
White grapes (Albana: A; Pignoletto: P) and coloured grapes (Lambrusco: L; Sangiovese: S). Farming methodologies: Traditional (T); Organic (O); Biodynamic (B). Data are expressed as 10 nmol $gFW^{-1}$ (catechins) and nmol $gFW^{-1}$ (stilbenes) ± SD (N = 2).

The HPLC-DAD quantification of polyphenols revealed that the 'Lambrusco' samples were particularly rich in stilbenes (fig. 1). The coloured berries were found to contain high levels of catechins, in particular epigallocatechin and catechin, while epicatechin was the most abundant in the white ones (data not shown). In all samples, catechins were on average 10-times more concentrated than stilbenes (fig. 1).

## 4. CONCLUSIONS

The results showed that, among the analysed cultivars from Emilia-Romagna, the coloured ones were more rich in nutraceuticals than the white ones. In particular 'Lambrusco' showed high anthocyanin, catechin and stilbene amounts, while the highest antioxidant activity and amine levels were found in 'Sangiovese'. The

different levels of metabolites detected among the samples seemed to be mainly related to the type of cultivar rather than to the vineyard management methodologies.

Results from the present study support the need for determination of nutraceutical properties (i.e. high level of polyphenols) and potentially allergenic compounds (biogenic amines and polyamines) in grape and wine, considering their relevant social impact in the global food world. Research has to be further improved to compare the effects of different grape farming methodologies with the presence of several health-related molecules.

**Abstract**

In this work, results about the composition in polyphenols and polyamines in important wine-grape cultivars from the Emilia-Romagna region are presented. Spectrophotometric and HPLC analyses suggest that especially coloured berries are particularly rich of antioxidant species (stilbenes and catechins). Potential allergenic capability of biogenic amines was also characterized.

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