Physicochemical Characterization of Tropical Wines Produced in the Northeast of Brazil

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Abstract

Young varietal and experimental wines from *Vitis vinifera* L. – Petit Verdot and Tempranillo – cultivated in a tropical semiarid region (Northeast Brazil) were characterized with regard to their phenols and organic acids. The wine was evaluated using spectrophotometry and high performance liquid chromatography to determine total polyphenols, total anthocyanins and organic acids. The Petit Verdot wines showed highest polyphenols and anthocyanins concentrations. However, the Tempranillo wine showed highest acidity. Both cultivars produce typical tropical red wines in the Northeast of Brazil.

INTRODUCTION

The production and wine quality depend on many factors, like edafoclimate conditions. The lower-middle region of the São Francisco river Valley, in the Northeast of Brazil, is located between the 8º and 9º parallels of the Southern hemisphere, characterized by a tropical semiarid climate. Grape production can be scaled throughout the year and one vine can produce two or three times per year (Pereira et al., 2007; Tonietto and Carbonneau, 2004). This characteristic is the case because region has high solar radiation, temperatures and water for irrigation, that can vary according to the month in the year, providing typical variations in the phenolic and organic acid composition of the grapes and consequently in the wines (Lima, 2010; Rastija et al., 2008; Pereira et al., 2005). Moreover the phenolic compounds are found to be associated with biochemical and pharmacological effects that are beneficial to human health (Guerrero et al., 2009; Kumar et al., 2009). And the acid composition found association to aging wines.

This evidence motivated this study, which aims to evaluate the organic acid and phenolic compositions of tropical wines produced in the Northeast of Brazil.

MATERIALS AND METHODS

Winemaking

Young monovarietal and experimental wines were produced with *V. viniferas* L. cv. Petit Verdot and Tempranillo, cultivated in the Casa Nova/BA, Northeast of Brazil, which harvests were carried out in July 2008. Eighty kg of grapes from each variety were vinified on a semi-industrial scale, followed by manual bottling (Peynaud, 1997). The determinations of the polyphenols and organic acids were performed after 3 months of storage in 750-ml bottles with agglomerated cork stoppers in a wine cellar heated at 18 ± 1ºC and with an average relative humidity of 60%.

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Determination of the Polyphenols and Organic Acids of Tropical Wines

Polyphenolic: the index at 280 nm (I_{280nm}) was found by reading the absorbance of wines diluted in water at 2%, at 280 nm using quartz cuvettes and a Varian 50 Bio UV/Vis spectrophotometer (Harbertson and Spayd, 2006).

Total anthocyanins: this analysis was done using the spectrophotometer method of differential pH by changing the chromophoric structure of anthocyanins in acidic medium according to OIV (*Office International de la Vigne et du Vin*, 1990).

Organic acids: organic acids (tartaric, malic, lactic, citric and succinic) were identified and quantified in the *Ultimate* 3000 *Dionex®* liquid chromatograph with an *Acclaim®* 120 *Dionex* C-18 analytical column (250 mm x 4.6 mm, 5 μm), wavelength 210 nm. The mobile phase was prepared by mixing phosphoric acid (0,10%) and acetonitril (0,12%) in ultra-pure water (Milli-Q, Millipore ®). The compounds were quantified in an analytical curve with concentrations varying from 0.01 to 1.0 mg L^{-1} by external pattern (Lima et al., 2010).

Statistical Analysis

The results were obtained in triplicate and submitted to ANOVA and Duncan Test for comparison among averages ($p < 0.05$) and analysis of the principal components (APC). All statistical analysis was performed using the *Statistics for Windows 7®* *Software*.

RESULTS AND DISCUSSION

These results showed the interaction of the vine and edaphoclimate conditions produces typical variation in the physicochemical composition.

In the Table 1, the results confirmed the influence of grape variety on the polyphenol amounts in wines and showed the highest levels of total polyphenols and anthocyanin concentration in the Petit Verdot wines.

Moreover, it confirmed that tartaric and lactic acids are the main organic acids in the tropical red wines (Table 1). The wines showed the similar concentrations of tartaric, lactic and succinic acids. The results were similar to those reports by Zheng et al. (2009) – lactic acid, 3,4 g.L^{-1} and tartaric acid, 2,5 g.L^{-1} – for Australian red wines, and by Peres et al. (2009), in Brazilian red wines (harvests 2000 – 2002).

Considering the performance of malolactic fermentation and the little resistance to oxidation of malic acid, the absence of this acid was expected independently of the variety. Accretia also explains the fact of the malic decreasing during maturation of the grapes especially in warm climate (Rizzon and Sganzerla, 2007).

Multivariate Statistical Analysis

Separation of the tropical red wines was performed using values of total polyphenols ($I_{280 nm}$), total anthocyanins and organic acid composition. The first two principal components extracted 99.99% of the total variance, which the first principal component (PC1) represents 99.87%, was dominated by total polyphenols, total anthocyanins, tartaric, lactic acid and succinic acids and total organic acids (Fig. 1).

As can be seen in Figure 1, the Petit Verdot wines on the left of the graphic (in the negative side of PC1) were characterized by total anthocyanins, total polyphenols and lactic acid, and Tempranillo wines on the right of the graphic (in the positive side of PC1) were characterized by tartaric and succinic acids and total organic acids, as can be confirmed by values in the Table 1.

CONCLUSIONS

Variations in the phenolic and organic acid compositions of red tropical wines, elaborated from different grape cultivars, were found. However, the polyphenol levels and anthocyanins concentration remained higher than those reported for wines produced in temperate regions and similar composition to organic acid was observed.

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Tables

Table 1. Characterization of polyphenols and organic acids in tropical red wines.

Variety	POL[a] (I_{280nm})	ANT[b] (mg.L^{-1})	Organic Acid (g.L^{-1})				
			Tartaric	Malic	Lactic	Citric	Succinc
Petit Verdot	70,4[a] ±0,04	508,0[a] ±0,86	2,63[b] ±0,04	ND	7,30[a] ±0,01	ND	1,40[b] ±0,20
Tempranillo	69,1[b] ±0,36	356,6[b] ±0,72	2,78[a] ±0,01	ND	7,02[b] ±0,0,1	ND	1,78[a] ±0,01

a: polyphenols total índex of 280nm; b: total anthocyanins. Average followed of different letter significant difference according to the test of Duncan (p<0,05).
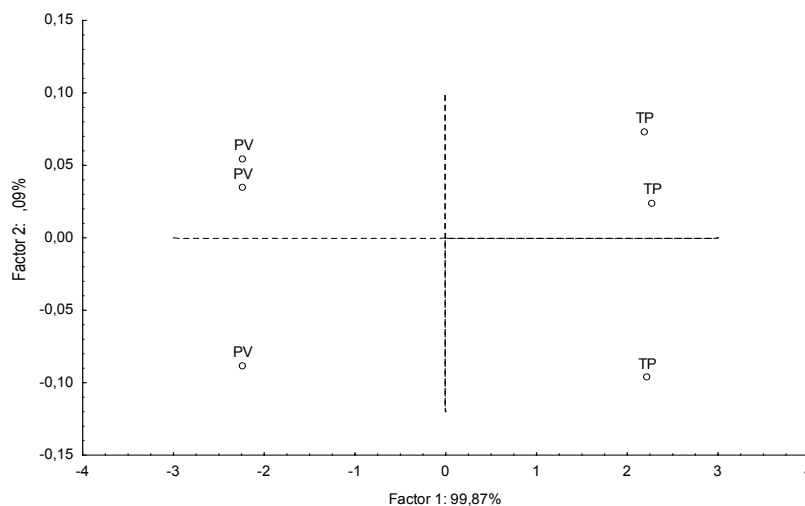
Figures

(A)
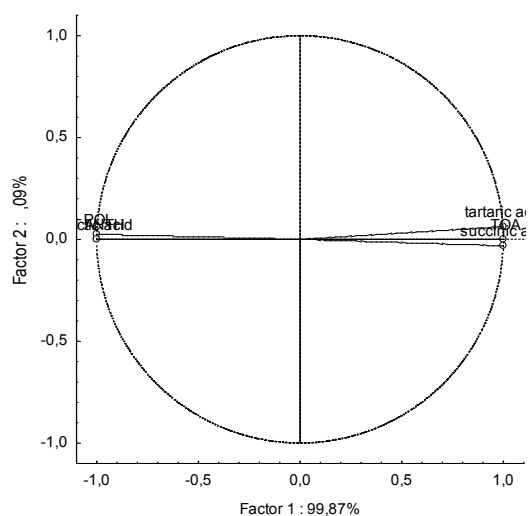
(B)

Fig. 1. Variable contribution (A) and the distribution of the red wines (B) (PV= Petit Verdot e TP = Tempranillo) in two dimension with the coordinates system defined the first and second principal component.