

Antioxidant Characteristics of Red Wines from Calchaquíes Valleys in Salta

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Abstract: Objectives: We analyzed polyphenol and antioxidant capacity in red wines *Malbec*, *Cabernet Sauvignon*, *Tannat* and *Syrah* varieties from wineries Calchaquíes Valleys, in Salta, Argentine. Methods: The total polyphenols was determined by UV absorption at 280 nm evaluating the D280 index. The antioxidant capacity was analyzed by absorbance measured at 520 nm and 420 nm and the color intensity and the hue was calculated by its summation by its relation. Key findings: The results presented indexes D280 (phenolic content) that ranged from 43.3 to 55.7. The antioxidant capacity is evaluate by the color intensity of red wines measuring absorbance values at 420 and 520 nm that ranged from 0.60 to 1.09. There is correlation between phenolic content and antioxidant capacity with a correlation coefficient of 0.974. Conclusions: The total polyphenol content in red wines is correlated with their antioxidant capacity. It is beneficial to health if the wine is consumed in low quantities. The *Cabernet Sauvignon* variety has more phenolic content than *Malbec*, *Tannat* and *Syrah* varieties.

Key words: Antioxidant capacity, red wines, Calchaquíes Valleys, Salta.

1. Introduction

The phenolic compounds of red wines have ability to inhibit human LDL (low-density lipoprotein) oxidation in vitro. The oxidated LDL induces platelet aggregation with a high incidence of coronary atherosclerosis. Therefore, the polyphenols possess protective effects against diabetes, cancer, viral infection, duodenal ulcer, inflammation and antiallergic action [1].

Within the vineyard location there are environmental and climatic conditions, soil type, geographic locations and grape maturity that determine the concentration of phenolic compounds and the quality of wine.

Kanner et al. [2] evaluated the anti-oxidative effects of wine phenolics on the catalysis of lipid peroxidation by biological catalysts. Vinson and Hontz [3] determined the antioxidant phenol index to measure the

antioxidant capacity in wines (phenolic content/IC50 of lipoprotein). Frankel et al. [4] evaluated the inhibition of oxidation of human LDL by phenolic substances in Californian red wine. Some authors [5-8] have investigated the antioxidant activity with phenolic content in Spanish, Italian and American wines. Of late, there have been a spate of reports considering the benefits to human health of a diet with moderate consumption of wine in the prevention of cardiovascular and cancer diseases. There are several natural antioxidants such as tocopherol, ascorbic acid, flavonoids, anthocyanins, carotenoids, phenolic acids and the wine is one of the relevant sources of polyphenols [9].

Many different methods have been used to measure the antioxidant activity in foods. In general, these methods are based on the ability of antioxidants to capture free radicals [7, 10].

Lipid phase detection methods are used, enzymatically generating the ABTS + radical or with the DPPH radical test, TAA test and total antioxidant

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status in aqueous phase, linoleate peroxidation (LH/LUV test) in membrane systems and antioxidant activity of nitrous oxide [7, 11-14].

The 40% of antioxidant capacity is attributed to the following polyphenols: anthocyanins (55%), tannins (25%), flavonols (15%) and water-soluble phenolic acids indicate a correlation of the color intensity with the antioxidant capacity of the wines, supporting the postulate of the importance of the anthocyanins in the total antioxidant capacity [15].

Biological studies on the polyphenols present in red wines indicate that they are bio-available compounds, so they are functional foods due to their content of natural antioxidants and they provide health benefits if there is a moderate consumption of wine [16].

The aim of this work was to study the phenolic compounds and antioxidant capacity of red wines from Calchaquíes Valleys in Salta. This region includes the departments of Cafayate, San Carlos, Molinos (Colomé) and Cachi. Here, there are 26 wineries which produce red wines *Cabernet Sauvignon*, *Malbec*, *Syrah* and *Tannat* variety. These results will be disseminated to the community and transferred to the wineries in the area.

2. Materials and Methods

Eighteen samples of 1 liter bottles red wines are

from wineries Calchaquíes Valleys, *Malbec*, *Cabernet Sauvignon*, *Tannat* and *Syrah* varieties. These wines by triplication were evaluated the total polyphenols by UV absorption at 280 nm determining the D280 index according to Ribéreau-Gayon technique [17]. The antioxidant capacity was analyzed by absorbance measured at 520 nm and 420 nm and the color intensity and the hue was calculated by its summation by its relation using the technique of Ursini et al. [15]. In the statistical analysis, the analysis of the variance was applied to the results, the Turkey test to compare means and principal components analysis (PCA) with the statistical program InfoStat [18].

3. Results and Discussion

The results presented phenolic contents with D280 index ranging from 43.3 to 55.7 (Fig. 1). The antioxidant capacity *in vitro* gives an approximate idea of what happens in complex situations *in vivo*. The antioxidant activity is generally calculated by the sum of the antioxidant activities of the individual components of the product, sometimes modified by the synergistic or inhibitory effect of each of them. The total content of polyphenols in red wines correlates with their antioxidant capacity [5]. The effects of these antioxidant characteristic in human studies when there is a moderate consumption of red wines in the diet

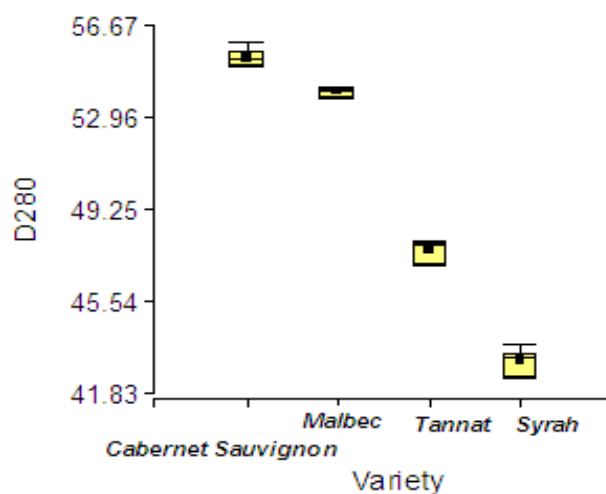


Fig. 1 Absorbance values to 280 nm.

demonstrated the resistance of LDL to oxidation [16].

Wines having a maximum in the spectrum at wavelengths of 280 nm and the total content of polyphenols can be quantified by direct reading of the absorbance. From measurements of total polyphenol content by the Folin-Ciocalteu method or by absorbance readings at 280 nm (D280), the antioxidant activity of wines can be predicted [19].

Some authors found a direct correlation between total polyphenols and antioxidant activity determined by the percentage of inhibition of the oxidation of LDL [3-5], analyzing wines of different origins reported a linear relationship between total polyphenols and the value of superoxide radicals (SOSA) obtained similar results when measuring the total antioxidant activity by the radical ABTS in Italian wines [6].

Sánchez-Moreno et al. [20] applied the DPPH test to quantify the antioxidant capacity in Spanish wines and found a linear relationship between total phenol content and AE (antiradical efficiency), which is equal to the inverse of EC 50 by time. According to these studies, red wines can be considered functional foods because of their content of natural antioxidants with physiologically active and bio-available components (polyphenols) [20].

The moderate consumption of red wines is beneficial to the health of the population. This was demonstrated

on the human intervention studies conducted by Leighton [16] in Chile. He supplemented the diet with 240 mL of red wine and evaluated at 90th day that the antioxidant capacity of plasma and the plasma polyphenols increased.

Also, the antioxidant capacity measured by the color intensity of red wines was calculated as the sum values of absorbances at 420 and 520 nm with values ranging from 0.60 to 1.09 as shown in Fig. 2.

It was determined that the antioxidant capacity and the total polyphenols (D280) have a correlation coefficient of 0.974, as can be observed in Fig. 3. This evidences that the *Cabernet Sauvignon* variety has greater antioxidant capacity, following in order of importance of the *Malbec*, *Tannat* and *Syrah* varieties.

Ursini et al. [15] report a correlation coefficient of 0.99 between the color intensity and the antioxidant capacity of the wines, confirming the importance of anthocyanins in total antioxidant capacity.

The antioxidant capacity is determined by the color intensity of red wines by the red anthocyanins and yellow-brown tannins. The values of hue were determined through the relationship between the absorbances at 420 and 520 nm, with values ranging from 0.79 to 0.93 indicating that the *Cabernet Sauvignon* variety exhibited the highest values as shown in Fig. 4.

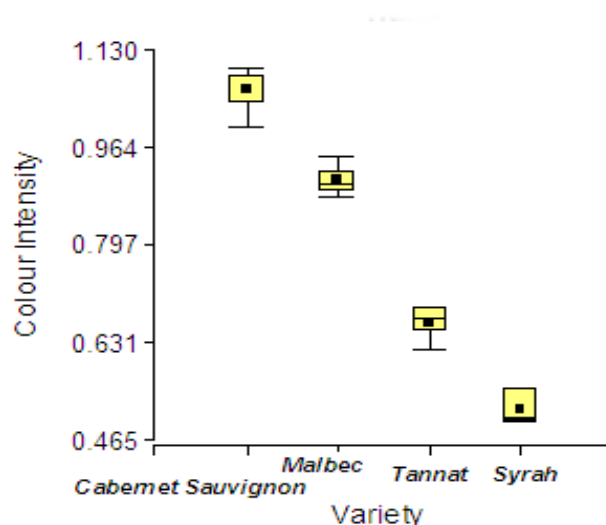


Fig. 2 Color intensity of red wines.

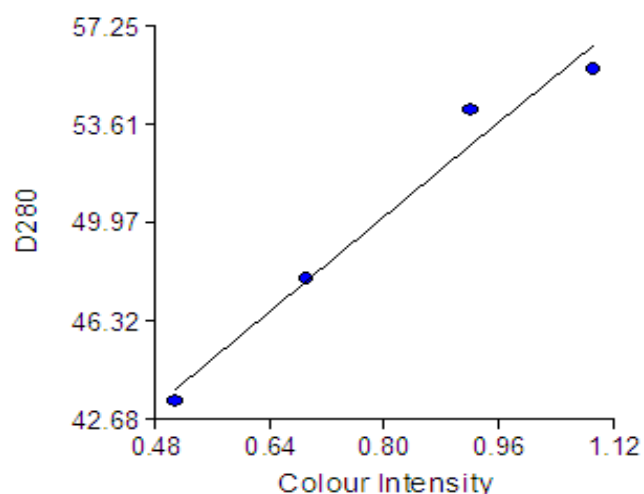


Fig. 3 Correlation between the color intensity intensidad and D280.

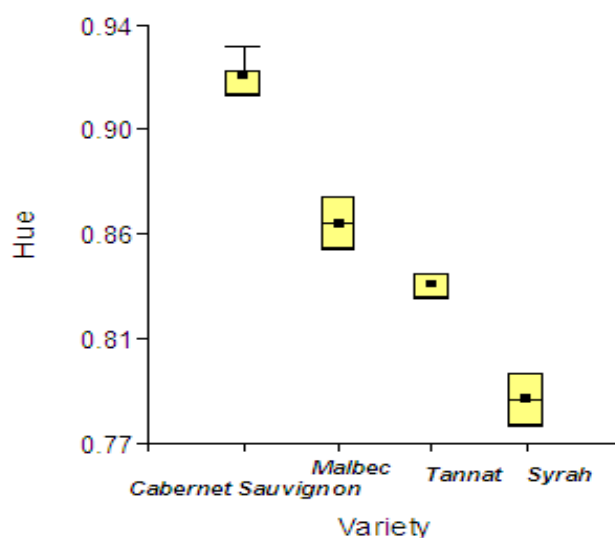


Fig. 4 Hue values of red wines.

The main phenolic constituents of the wine with antioxidant capacity are those derived from phenolic acids, cinnamic acids, flavonoids, procyanidins and stilbenes, which come from the skin, seed and pulp of the grape.

After studying the antioxidant capacity of the different polyphenolic fractions of the wine, Ghiselli et al. [8] suggested that anthocyanins would play an important role in total antioxidant activity.

PCA (principal component analysis) was applied to evaluate the relationship between D280, color intensity

and hue that is observed in Fig. 5. It can be seen that component 1 participates with 97.4% and component 2 with 2.3%. This evidences the association of *Malbec* and *Cabernet Sauvignon* varieties with the highest values of hue, color intensity and polyphenol content while the *Syrah* and *Tannat* varieties are associated with lower values of these results. The e_1 and e_2 autovectors were 0.58, and -0.29 for the values of D280, 0.58 and -0.51 for the color intensity, 0.57 and 0.81 for the hue, respectively.

From this multivariate analysis, we emphasized that

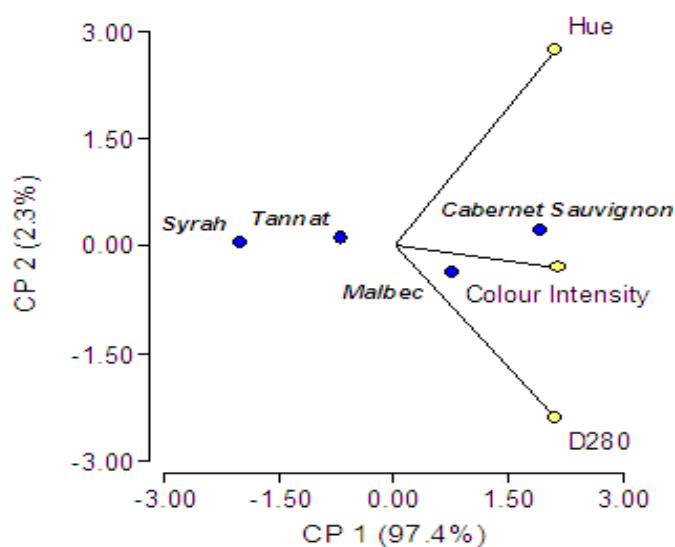


Fig. 5 Principal component analysis of red wines.

the *Cabernet Sauvignon* and *Malbec* varieties present better polyphenolic characteristics and antioxidant capacity. The red wines provided are beneficial to the health if moderate consumption is performed [21, 22].

4. Conclusions

The regional red wines presented phenolic contents with D280 indexes ranging from 42.4 to 61.8; with the highest values for the *Cabernet Sauvignon* and *Malbec* varieties. The antioxidant capacity measured by the color intensity of red wines as the sum of absorbance at 420 and 520 nm ranging from 0.51 to 1.05. There is correlation between the total polyphenols content and the antioxidant capacity with a correlation coefficient of 0.974. It was determined that the *Cabernet Sauvignon* variety evidences greater antioxidant capacity, following in second order of importance of the *Malbec*, *Tannat* and *Syrah* varieties. Suggestions for future research are *in vivo* antioxidant capacity analysis of regional red wines to confirm *in vitro* results.

These results are of technological value and of importance for health considering that numerous studies have demonstrated the moderate consumption of red wines is beneficial for the antioxidant action of polyphenols. These compounds prevent the oxidation

of LDL in humans which causes cardiovascular lesions. Also, the polyphenols have protective effects in pathologies such as diabetes, cancer, etc. These studies are relevant for the typification and characterization of red wines from the Calchaquíes Valleys of northern Argentina to obtain its controlled denomination of origin in the future increasing its marketing value.

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Conflict or interests

The authors declare that they have no conflicts of interest to disclose.

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