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Study of Physico-Chemical Components of "Gemza" and "Pamid" Grape Varieties Cultivated in Albania

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Abstract

The application of different fermentation techniques for wine production has always been associated with the effects of the chemical components of the final product. Many authors have stated that skins and seeds are higher in polyphenolic content and with a great importance for the quality of the wine. Based on this fact, the objective of this study is to evaluate the effect of different vinification techniques on the chemical composition of wine. For this study, two grape varieties "Gemza" (G) and "Pamid" (P) cultivated in the Pogradec area were taken into consideration. For each of these two varieties were taken two different fermentation techniques, fermentation in the presence of skins (G1 and P1) and fermentation of grape juice without skins (G2 and P2). Before fermentation, the must was macerate at 5 ° C for 24 hours. To evaluate the impact of vinification techniques, physico-chemical analyzes were performed on grapes and wine. Analyzes performed by spectrophotometric methods are polyphenol index, total polyphenols, anthocyanins, tannins and color parameters. The results of this study show that vinification techniques had a significant difference with $P \leq 0.05$ Test Tukey in the content of polyphenols and color parameters. Based on the obtained results, we conclude that the application of different vinification techniques is associated with an increase in polyphenolic components, especially in fermentation with the presence of the skins.

Keywords: fermentation, wine, polyphenols, var. Gemza, var. Pamid

1. Introduction

The development of viticulture and enology in Albania dates back to ancient times, due to the soil and favorable climatic conditions. The combination of natural resources of the regions of the country and possible varieties will make possible the production of typical wines Gülcü, *et al*, 2018).

The chemical composition of grapes and wine is complex and varied. It is determined by a number of agronomic and technological factors. European winemakers have discovered that planting grapes in suitable soil can make the difference between an excellent wine and a poor wine (Cheng. *et al*, 2015).

Phenolic compounds are important in wines. They have a significant effect on the organoleptic profile of the wine, especially in terms of indicators such as color intensity or even taste characteristics. Given that most of these components pass from grapes, we can say that their content in wine is determined by the variety, and its potential and phenolic reserves. During alcoholic fermentation, thanks to the influence of various technological factors, the extraction of these components from the strong parts of the grapes takes place. (Lamce, *et al*, 2020; Yoncheva, *et al*, 2018; Niculescu, *et al*, 2018).

In recent years, due to the interest in the production of quality wines in addition to the work done, with the selection and cultivation of varieties suitable for the area, there has been a tendency to change or improve

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fermentation schemes (Lamce, *et al*, 2018;). This interest has also appeared due to the limited knowledge of grape varieties of specific areas with destination wine production (Mitrevska. *et al*, 2020). Based on this fact, the purpose of this study is to evaluate and study the characteristics of grape varieties such as Gemza and Pamid that find suitable cultivation in the area of Pogradec and their use for the production of red and rosè wine.

2. Materials and Methods

Vinification

For this study are taken into consideration two grape varieties that are cultivated in the area of Pogradec, var. Gemza and var. Pamid. The fruit is harvested at the time of technical maturity. After harvesting, these samples were transported to the Food Research Center of the Faculty of Biotechnology and Food. For this study, 100 kg of grapes were used for each variety, which were divided into two lots of 50 kg each.For the experiments, two fermentation schemes were followed, fermentation in the presence of skins, named P1 (for the Pamid variety) and G1 (for the Gemza variety) and fermentation in the absence of skins, named P2 (for the Pamid variety) and G2 (for the Gemza variety). The experimental tests were treated with a dose of 5g/hl SO_2 and placed in cold maceration for 24h at 5°C. After cold maceration, the experiments which would be performed in the absence of skins were pressed (P1 and G1), to the obtained juice was added 2 g/hl of the pectolytic enzyme for better rendering and left for static decantation (48h at 5°C).

To the samples of all four experiments were inoculated 20 g/hl of *S. bayanus* BC yeast, and fermenting at a controlled temperature of 20-22ºC for 10 days.

Fermentation performance was checked every day (% of sugar and temperature). The samples were taken for analysis of total polyphenols, IPT, content of tannins, content of anthocyanins and color parameters in the beginning and at the end of fermentation. Samples prior to analysis were centrifuged to remove solid suspensions. The samples were analyzed in triplicate

Analytical determinations of experimental wines.

The analytic determination included: free and total of sulfuric anhydride, total acidity, volatile acidity and alcoholic grade (Method OIV-MA-AS313-01). The determination of total polyphenols was performed according to the Folin – Ciocalteu method (Waterhouse, 2002) and results were expressed as Gallic acid equivalents (mg GAE/l). The determination of tannins is done according to the method described by Porter *et al.,* 1985, results were expressed in mg/L. Determination of total anthocyanins in wine is performed by the method described according to Puissant and Leon, 1967, and results were expressed as malvidin-3-glucoside equivalents (mg/l). Color evaluation is done according to Glories (1984) [abs. units]. The total polyphenols index was determined by Cetó *et al*., 2012 [abs. units].

Statistical analysis

Statistics Program, Version 9.0 (Analytical Software) was used for statistical analysis. Through the ANOVA test factor and Tukey test ($P \leq 0.05$), the study of the effect of each of the treatments on the total polyphenols content, total polyphenols index, total anthocyanins and color parameters of the experiments was performed.

3. Results and Discussion

Wine fermentation is a complex of biochemical processes that are associated with influences on the extraction of a number of ingredients very important in wine for both its aroma and taste (Añón, *et al*, 2014).

The wine samples in the study were initially analyzed for quality parameters and their content was within the limits set by the Regulation of EEC 1990.

Total polyphenols

The following figure shows the data of the content of total polyphenols in wines produced from Pamid and Gemza varieties with fermentation with and without skins.

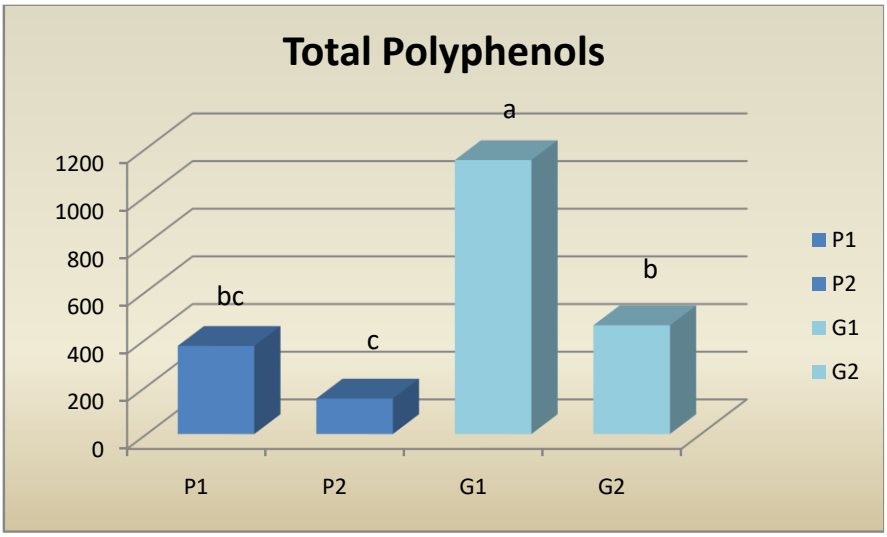

Figure 1. Total Polyphenols of experimental wines (Tukey Test, P ≤ 0.05)

As noted in Figure 1. the content of total polyphenols has significant difference from fermentation with skins compared to fermentation without skins. Fermentation with the skins for both varieties showed that there was a higher significant impact with a P ≤ 0:05 as is shown in Figure 1. Fermentation with skins is associated with higher values of total polyphenols. The high content of total polyphenols in fermentation in the presence of skins is always accompanied by an increase in the values of total polyphenols due to the extraction of these components from the skins (Cadota et al, 2012). Furthermore, Figure 1 shows that the wine produced by the *var*. Gemza had higher average values in the total polyphenols content (802.95 ± 388,7 mg/L) than the wine produced by the *var*. Pamid. The differences in this content between the varieties studied are similar to those found in the works carried out by Yoncheva et al., 2018.

Total polyphenols Index

Table 1. presents the index of total polyphenols (IPT) values for the four experiments followed. The highest value of IPT is presented by Gemza variety (23.6 - 43.73) in fermentation with the presence of skins, while the lowest value is presented in wine produced by fermentation in the absence of skins from Pamid variety (4.23 – 5.1). From Table 1. it is noticed that the presence of skins in fermentation for both these two varieties has a high impact on the content of IPT.

Table 1. The value of IPT in experimental wines

Samples	Time	IPT
P1[b]	1[c]	9.63 ± 0.15 [a]
	2	16.23 ± 0.12
P2	1	4.23 ± 0.12
	2	5.10 ± 0.00
G1	1	23.60 ± 0.05
	2	43.73 ± 0.06
G2	1	12.73 ± 0.03
	2	15.02 ± 0.03

a – Mean + SD

b – P1 – G1 –fermentation with skins; P2 – G2 fermentation without skins.

c- 1 –beginning of fermentation; 2 – ending of fermentation.

Total Anthocyanins.

Figure 2 shows the total anthocyanins content in wines for both varieties with two different fermentation schemes.

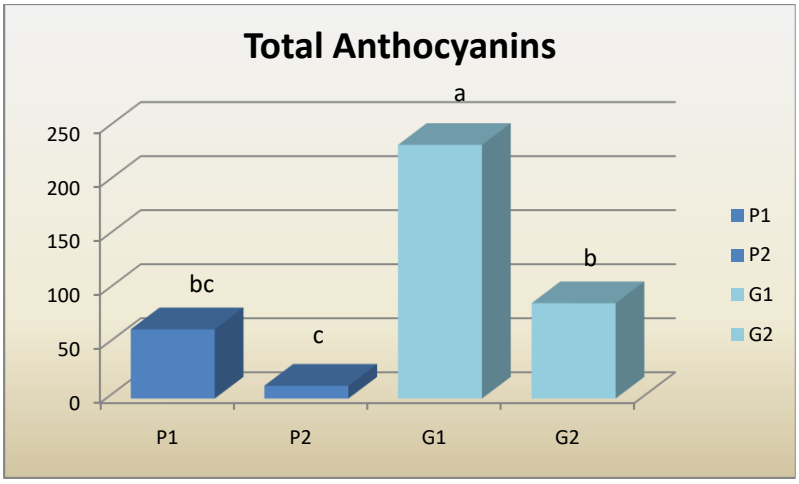

Figure 2. Total Anthocyanins in experimental wines (Tukey Test, P ≤ 0.05)

Figure 2 shows that the total anthocyanins content has presented a high average value in the wines produced by fermentation with skins for both varieties. Meanwhile, statistical analysis Anova confirms that the fermentation scheme has a significant influence (P ≤ 0.05) on the content of total anthocyanins in wines produced from both varieties.

If we compare the total content of anthocyanins for the two varieties in this study, it is observed that the wine produced by the Gemza variety represents an average value of this ingredient three times higher than the wines produced by the Pamid variety. Moreover, the statistical analysis of Anova shows that the total content of anthocyanins represents a significant difference (P ≤ 0.05) that is influenced by genetic factors such as diversity. From the bibliographic study, the results of this work are similar to the results presented by the study conducted by the group of authors Yoncheva et al, 2018. It should also be noted that varieties that present a low amount of total anthocyanins are suitable for the production of rosé wines, as it is known that these ingredients are responsible for the color of red wines (Gabrielyan and Kazumyan, 2018). Therefore, wines made from the Pamid variety would be more suitable for making rosé wines than wines made from the Gemza variety.

Color parameters

Table 2 presents the data of color parameters in the wines produced for this study.

Table 2. Color parameters of experimental wines

Samples	Time	Intensity of color	Index of color	Hue of color
P1[b]	1[c]	2.34 ± 0.01 [a]	0.96 ± 0.00	1.05 ± 0.00
	2	1.48 ± 0.01	1.61 ± 0.00	0.62 ± 0.00
P2	1	0.77 ± 0.00	0.74 ± 0.00	1.36 ± 0.00
	2	0.74 ± 0.00	0.91 ± 0.02	1.09 ± 0.03
G1	1	3.41 ± 0.03	1.05 ± 0.00	0.95 ± 0.00
	2	2.19 ± 0.01	1.49 ± 0.01	0.67 ± 0.00
G2	1	3.88 ± 0.01	1.90 ± 0.02	0.52 ± 0.00
	2	6.79 ± 0.02	1.81 ± 0.00	0.55 ± 0.00

a – Mean + SD

b – P1 – G1 –fermentation with skins; P2 – G2 fermentation without skins.

c- 1 –beginning of fermentation; 2 – ending of fermentation.

Wines produced by fermentation in the presence of skins (P1, G1) have considerable values of color parameters than wines produced by fermentation without skins. The presence of skins during fermentation confirms that their presence favors the extraction of polyphenols responsible for color but also from this graph it can be seen that skins do not affect the oxidation of wine (Pascual et al., 2016).

Total Tannins

Figure 3. shows the values of total tannins in wines produced from Pamid and Gemza varieties with two different fermentation schemes.

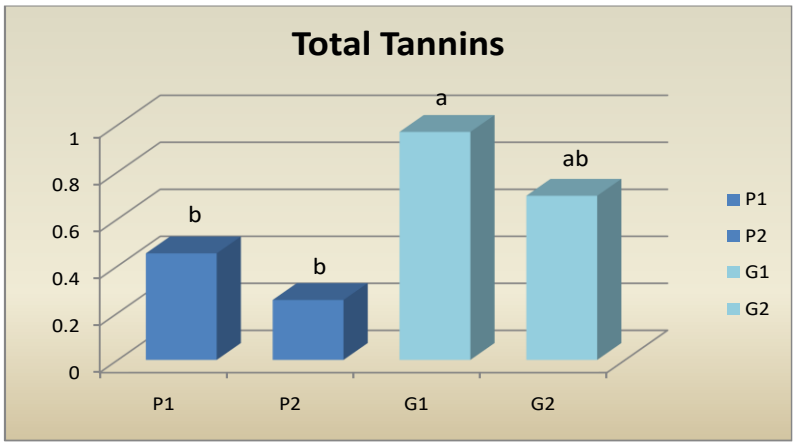

Figure 3. Total Tannins of experimental wines (Tukey Test, P < 0.05)

As seen in figure 3. one of the varieties that is distinguished for a high value of total tannins is Gemza in both fermentations, compared to the Pamid variety. According to the figure it is also noticed that the difference between two fermentations for the same variety is not very high, this means that the value of the tannins content is influenced more by the variety than the fermentation technique (Cáceres-Mella *et al*, 2013), this impact was also expressed by the statistical analysis ANOVA which showed a significant difference P <0.05.

4. Conclusions

From the data obtained from this study we can summarize that, for both varieties which are cultivated in the Pogradec area, they present good qualities for wine production.

Fermentation in the presence of skins for both varieties was more positive compared to fermentation in its absence. This advantage of fermentation with skins was clearly expressed, as it was associated with a high content of total polyphenols, total anthocyanins, total tannins, in IPT values as well as color parameters in experimental wines.

Despite the influence of the fermentation scheme the Pamid variety for all the defined indicators showed lower values compared to the Gemza variety. Low content of polyphenols responsible for color in *var.* Pamid makes it suitable for the production of rosé wines.

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