Quality Parameters of Red Wine Produced From 'Kallmet' Grape Variety, Grown In Albanian Territory

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Abstract

'Kallmet' is one of the oldest autochthonous grape cultivar which is being used through centuries as one of the most widespread red wine cultivar, especially in the North and North-west of Albania. Kallmet grape variety produces alcoholic red wines of high quality. Knowledge of the chemical composition of wine and its association with the grape cultivar is of paramount importance in oenology and a necessary tool for marketing. Phenolic compounds are very important quality parameters of wine because of their impact on color, taste and health properties. Quality and quantity of polyphenols are related to the grape variety, climatic conditions and cultivation practices. The aim of the present work was to study and describe these quality parameters of 25 young and aged red wines produced from Kallmet autochthonous grape variety. The color of wine is affected by several factors, among the more important being grape variety, pH, temperature, oenological treatments and aging. Great amount of polyphenols and anthocyanins are found on Kallmet young red wines. For this purpose, the following indicators were measured: color intensity, color tint, the percentage of red, yellow and blue color and defined variables X, Y, Z, using the CIE system (Commission Internationale de l'ECLAIRAGE).

1. Introduction

Albania, as typical Mediterranean country, enjoys the best conditions for vineyards and its geographic elevation makes it a perfect setting for wine production. The territory of Shkodra and Lezha is harmoniously shaped by the interaction of four ecosystems, the Albanian Alps, the Buna and Drin rivers, the Adriatic Sea and the Shkodra Lake – the largest lake of the Balkan. Gentle hills rim small villages as Naraç, Hajmel and Kallmet that gives the name to the most renowned Northern Albanian grape variety. This is the birthplace of the autochthonous grape varieties Kallmet that claim unique morph-biological characteristics. Kallmet gives alcoholic wines of high quality, while in 1982 in an international meeting organized for evaluation of wines in France wine from Kallmet cultivar was awarded with golden medal. Kallmet red wine has light color, is dry and have steady tannins content. Wine has a pleasing aroma of blackberry and blueberry fruit.

The phenolic compounds of red wines are substances which play an important role in several sensory properties such as color, flavor, astringency and hardness (Rubichaud and Noble, 1990). Furthermore its well known that wines are rich in phenolic compounds, which have been exhibited to be powerful antioxidants. Antioxidants play a crucial role in the prevention of many diseases such as cancer, inhibiting tumour initiation and heart disease (Briviba and Sies, 1994; Husain et al., 1987). These protective health effects derived from the consumption of wines have been attributed to their phenolic contents (Huang et al., 1992; Rice-Evans and Packer, 1998). The types and concentrations of the phenolic compounds in wines depend on grape cultivars, ripening and climatic conditions (Goldberg et al., 1998).

Color is one of the main sensorial characteristics used to establish the quality and acceptability of wine. The red color of wines is mainly due to both anthocyanins and polymeric pigments and depends on several factors, including the age of wine. During maturation, ageing and storage red wines change their sensory variables. For instance, the color of red wine loses its vividness and brightness. This change is mostly due to polymerization processes with the involvement of free monomeric anthocyanins (Glories, 1984 a,b). After 1 year of storage free monomeric anthocyanins are half reduced in comparison with initial concentration, and in older

aged wines they have almost faded away (Somers, 1971). The color intensity and tint are substantially dependent on pH and the presence of sulfur dioxide (Brouillard et al., 1978). The intensity of red color decreases with increasing pH value. The polymeric anthocyanins are generated in the processes of direct condensation and co-pigmentation (Asen et al., 1972; Santos-Buelga et al., 1995; Liao et al., 1992).

These newly formed pigments are chemically more stable than the free monomeric forms and they stabilize the wine color changing it to a more brick red hue (Mateus and de Freitas, 2001). The proportion of yellow color of aged wine is simultaneously enhanced with the increase of polymerization and oxidation degree. Another important factor that affects the color of wine is the self-association of anthocyanins, resulting in an over proportional increase of color intensity. A good knowledge of parameters characterizing the color spectrum of red wines helps the experts in assessing wine quality. The aim of this study is to assess color variables, anthocyanins and polyphenols contents in 25 young and aged red wines from Kallmeti grape variety.

2. Material And Methods

2.1. Red wine samples

For this paper were taken in study twenty five red wines produced from Albanian grape variety Kallmet. The grapes were harvest at their mature state, brought at the canteen of the Faculty of Biotechnology and Food where was produced red wine using the traditional method of vinification. The fermentation process was controlled daily and fermentation temperature fluctuated from 25-27 ^{0}C. At the end of fermentation, red wines were not filtrated. Before bottling SO_2 level were regulate to 30mg/L, and then were stored in cellar of the Faculty of Biotechnology and Food. Young red wines and two years aged red wines were analyzed.

2.2. Analysis methods

Total phenolic contents of the wine samples were determined spectrophotometrically according to the Folin-Ciocalteu colorimetric method (OIV), calibrating against gallic acid standards and expressing the results as mg gallic acid equivalents (GAE) extract.

The total anthocyanins were determined by the pH-differential method described by Giusti and Wrolstad (Guisti, M. M. et al., 2003). For this purpose, aliquots of red wine were adjusted to pH 1.0 and 4.5 with buffers. The absorbance of each solution was measured at wavelength of maximum absorption and 700nm. The difference in the absorbance values pH 1.0 and 4.5 was directly proportional to total anthocyanin concentration, which was expressed in mg/L.

2.3. Color measurements

Monomeric and polymeric anthocyanins: the contribution of monomeric anthocyanins to the color of red wine at pH 3.6 (% monomeric), and the degree of anthocyanin polymerization (% polymerization) were determined using the colorimetric effects that SO_2 and acetaldehyde have in the forms of anthocyanins, following the method proposed by Levengood and Boulton (2004). The analysis was conducted by spectrophotometry, and the absorbance (520 nm) was measured in 10 mm cuvette. Color fractions of the monomeric (MA %) and polymerized anthocyanins (PA %) were determined through the following calculations:

$$MA\,\% = (A^{20} - A^{SO2})/A^{acet} \times 100$$

$$PA\,\% = \frac{A^{SO2}}{A^{acet}} \times 100$$

Color Intensity (CI), Tint (T): CI and T were determined using the spectrophotometric absorbance of the red wines at 420, 520 nm (GLORIES, 1984), and the following calculations:

$$CI = Abs^{420} + Abs^{520}$$
$$T = Abs^{420}/Abs^{520}$$

3. Results And Discussion

Low color tint values, not exceeding T=0.6, are characteristic for young red wines (Glories, 1984, a,b). By comparing the results of absorbance values for red wines produced from autochthonous variety *Kallmet*, for color tint (T) and color intensity (I), we observe that the color tint increase after two years of aging, while color intensity (CI) decreases. In chart 1 is presented the comparison of color tint (T) and color intensity (CI) as a mean of twenty five samples of Kallmet young red wines and two years aged red wines. This is in accordance with the rule, which say that the absorbance reading for aged wines at 520 nm decreases while at 420 nm increases, due to the shift from monomeric to polymeric anthocyanins.

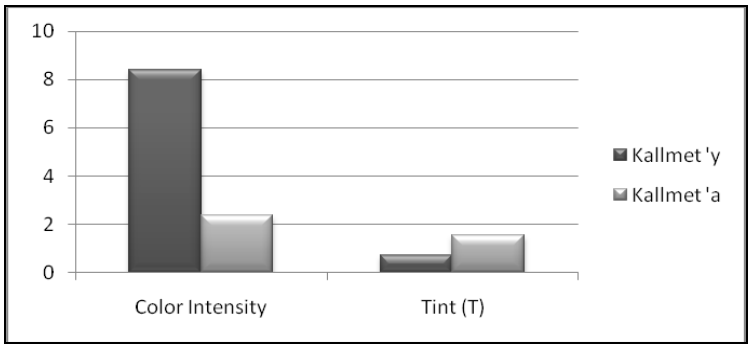

Chart 1. Changing of Color intensity and Tint (expresed as mean of twenty five samples) in young and aged Kallmet red wine. y – young red wines; a – aged red wines.

The value of color tint for young wines ranges from 0.68 – 0.73. These values are characteristic for young red wines, which increases on levels 1.53 while the wine ages. Color intensity for Kallmet red wine decreases with 72% while the tint increases with 112% compared with parameters for young red wines. The biggest change of tint value is observed for Kallmet wines after two years of aging. These wines have undergone the greatest transformation of color from bright red for young wines to orange – red after 2 years of aging in bottle (Chart 2.)

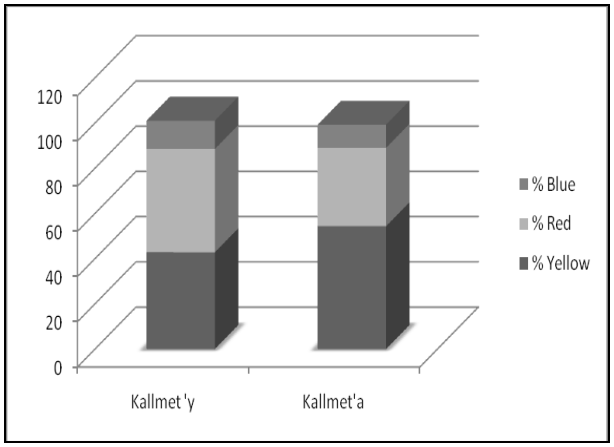

Chart 2. Contribution of red, yellow and blue color on color of young and aged Kallmet red wines. y – Young red wine; a – aged red wine

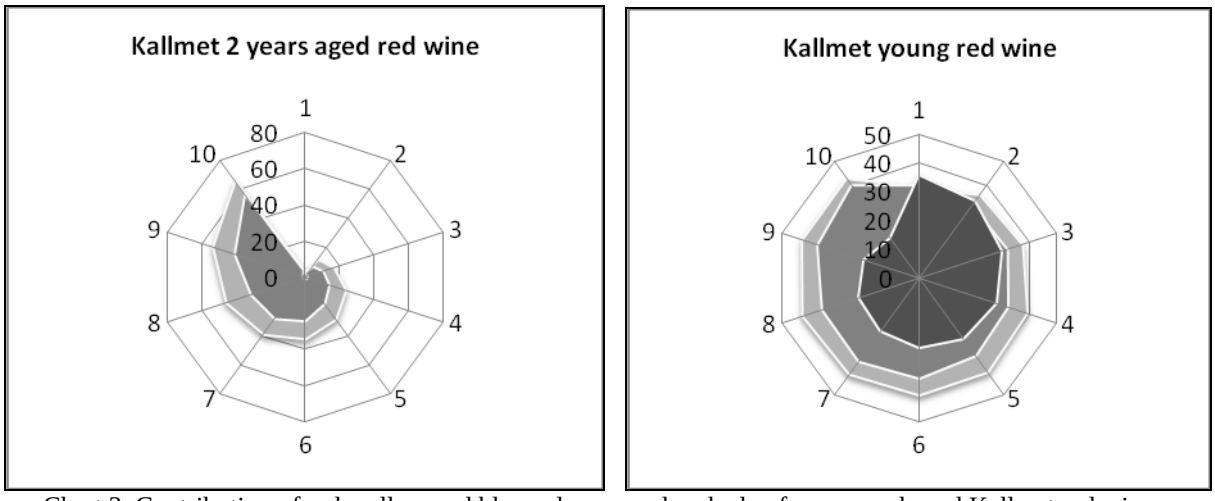

Chart 3. Contribution of red, yellow and blue colors on color shade of young and aged Kallmet red wines.

In general case, for wine with red shade, the red pigment class participates in more measure (over 40%) to underline the wine color, for wine with orange-red shade, the red pigment percent decrease (< 40%) being accompanied by yellow – orange pigments percent increasing (over 45%). For young wines the percent of red color range from 46% - 53%, while the percentage of yellow from 36%- 41%. These values change during ageing where the red contribution decrease to less than 44% while the yellow percentage increase to more than 43%.

In chart 2 and 3 are presented the contribution of red, yellow and blue color on color shade of Kallmet red wines. For the young red wines the contribution of red color is 46%, yellow color 43% and blue color with 13%. After two years of ageing these contribution changes in these direction: the red color contribution drops with 24%, yellow contribution increases with 27% while the blue contribution decreases with 18%. These changes, after two years of ageing in bottle, causes the yellow color proportion exceeds that of the red color in *Kallmet* wines. These wines have strongly altered chromatic characteristics shifted to the yellow tones of the spectrum while they age. These results reveal that wines from typical Albanian grape variety *Kallmet* have less expressed red color in aged wines.

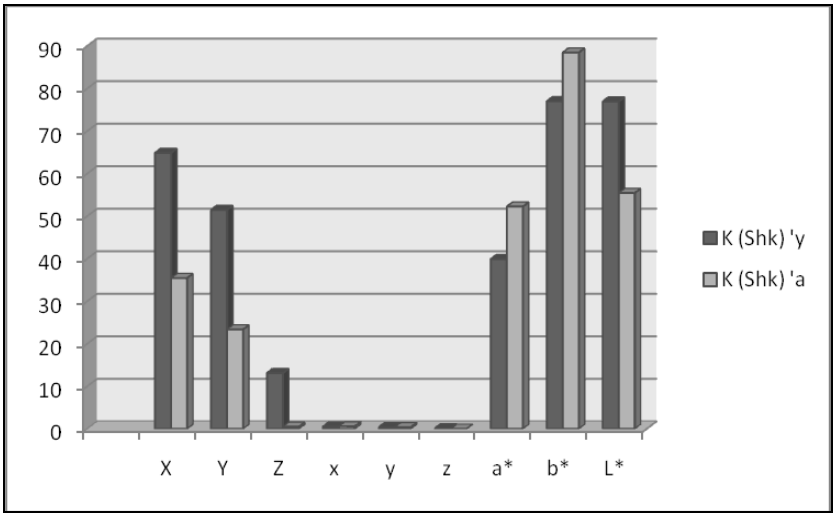

Chart 4. The experimental results of tri stimulus values, chromaticity coordinated and CIELAB coordinates for Kallmet red wine obtained according to CIE 1964 (x, y) color system (CIEXYZ) and CIELAB coordinates.

The color parameters determined in Chart 4 were as follows: tristimulus value, X, Y, Z; chromaticity coordinates x, y, z obtained by standardizing tristimulus values and CIELAB coordinates. Color coordinates L* represents the lightness and a* and b* indicate the change in hue from red to green and from yellow to blue, respectively. All parameter showed variability during ageing. Lightness L decreases while wine age, the same happen with tristimulus values X, Y, Z. The color of wine moves from red for young wines to orange color for two years aged wines.

Table 2. The colors contribution, polyphenols and anthocyanins content in young and aged Kallmet red wine.

Parameters	Young Kallmet red wine	Aged Kallmet red wine
% Yellow	42.8	54.32
% Red	45.7	34.7
% Blue	12.54	10.18
Total polyphenols (mg/L)	1307	287
Total anthocyanins (mg/L)	170.3	108
Monomeric anthocyanins (%)	24.47	15.51
Polymeric anthocyanins (%)	70.99	66.05

The data for total phenolic content show that Kallmet red wines hold a relatively high phenolic load level. From the data in table 2, the polyphenolic content in Kallmet red wines is 1307 mg/L GAE for young wine, value which drops with 78% while wine ages. The total anthocyanins decreases with 37%, and monomeric and polymeric anthocyanin content decreases too. Polyphenolic and anthocyanin content are a measure of antioxidant power of red wines. These quantities contribute to the definition of organoleptic quality, food-hygiene and the wine particularization.

4. Conclusion

"Kallmet" is one of the oldest autochthonous grape cultivar which is being used through centuries as one of the most widespread red wine cultivar, especially in the North and North-west of Albania. The present study is a snapshot of quality parameters for young and aged mono-varietal red wines produced from native Albanian grape variety 'Kallmet". The results for wine color parameters, total anthocyanins and total polyphenolic content show a potential of Kallmet grape variety in producing quality red wines which are good but ages fast, so these wines are not suitable for long time ageing.

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