Wines' Volatile and Non-Volatile Characterization

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Contributor: Silvia Pérez-Magariño

Phenolic and volatile compounds have been the most common variables studied in wines due to their importance in chemical, physical and sensory properties. Phenolic compounds come from grapes and oak wood of the barrels where wines are aged and affect color and gustatory properties of wines, such as astringency, bitterness and structure.

wine differentiation phenols volatile compounds polysaccharides geographical origin

1. Overview

The quality of wines has often been associated with their geographical area of production, as well as the grape variety used in their elaboration. Many research studies have been carried out to characterize and differentiate between red wines labeled with Protected Designation of Origin (PDO) from different geographical areas, but very few have been carried out on white and rosé wines. The objective of this work was to characterize white and rosé PDO wines from different geographical areas of Spain very close to each other elaborated with different grape varieties and select the variables that most contribute to their differentiation. Analysis of variance (ANOVA) and principal component analysis (PCA) were used as statistical methods. The ethanol content was the nonvolatile variable that most contributed to differentiating between some of the white and rosé wines according to their PDO. The white wines from RD (Ribera del Duero) and BI (Bierzo) were characterized by a high terpenic content (floral notes) while the wines from RU (Rueda), TO (Toro) and CI (Cigales)by a high content of ethyl esters and alcohol acetates (fruity aromas). The rosé wines elaborated with the Mencía grape variety from BI were characterized by their highest polysaccharidic content, which could have a positive sensory effect on the mouthfeel. The rosé wines from CI were characterized by their volatile profile complexity, having the highest content of volatile compounds from the oak wood, terpenes and C6 alcohols which provide pleasant woody, floral and herbaceous aromas. On the contrary, the RD wines were richest in alcohol acetates responsible for fruity aromas.

2. Phenolic and Volatile Compounds

Phenolic and volatile compounds have been the most common variables studied in wines due to their importance in chemical, physical and sensory properties [1][2][3][4]. Phenolic compounds come from grapes and oak wood of the barrels where wines are aged and affect color and gustatory properties of wines, such as astringency, bitterness and structure [1][2]. On the other hand, volatile compounds affect the olfactory quality of wines, which can come from grapes and the fermentation and aging processes of wines which affect the fruity, floral, herbaceous and toasted notes [3][4]. Other molecules, such as polysaccharides, have also been studied in the recent years because they have gained interest, mainly due to their influence in the olfactory and gustatory sensory phases of wines [5][6][7]. These compounds are usually grouped according to their origin, mainly, grapes and yeasts [8] and, to a lesser extent, those that come from oak wood barrels used for the aging process [9]. Organic acids, glycerol and ethanol content as well as pH and total acidity can influence the gustatory sensory properties of wines such as acidity, sweetness, body, bitterness and astringency [10][11][12][13].

All these compounds can vary largely in wines due to several factors such as environmental characteristics of the geographical region, grape varieties used in the winemaking, vineyard location, the fermentation yeast strain used as well as local know-how applied in the winemaking [14][15][16][17]. Thus, wines labeled with Protected Designation of Origin (PDO) are characterized by particular physicochemical and sensory properties which may allow differentiating these wines from those elaborated in other geographical areas. Nowadays, consumers consider the origin of wines to be one of the most important factors when buying a wine, as well as other factors such as price, grape variety and wine category that might earn the consumer's liking for a wine [18][19].

Several studies carried out in different regions of several countries have shown that the composition of wines (volatile and nonvolatile compounds) can be very different depending on the aspects mentioned above [14][15][20][21][22][23][24]. Spain is one of the main wine-producing countries in the world with seventy-five recognized PDOs. The Castile and León region located in the North of Spain is one of the most important winemaking regions with thirteen PDOs, many of them very close geographically. However, it is not easy to differentiate between their wines due to the proximity between PDOs and also because the same grape variety is used to elaborate the wines in many of them. Therefore, the objective of this work was to characterize white and rosé wines from the most important PDOs of Castile and León (Ribera del Duero, Rueda, Toro, Bierzo and Cigales) and select the variables that most contribute to their differentiation.

3. Conclusions

Several volatile and nonvolatile variables contributed, to a greater or lesser extent, to the differentiation of the studied white and rosé wines from the different PDOs located very close geographically. The white wines from RU and CI were characterized by the highest content of ethanol, while the wines from RD and BI by the highest content of glycerol, compounds that can affect gustatory attributes. The wines from RD and BI were characterized by a high terpenic content providing floral notes to these wines, while the wines from RU, TO and CI were characterized by a high prevalence of fruity aromas supplied by ethyl esters and alcohol acetates.

Clear differences were also found between the rosé wines, with the wines from RD being the most alcoholic ones. The wines elaborated with the Mencía grape variety from BI were characterized by the highest polysaccharidic content, which could have a positive sensory effect on the mouthfeel. The wines from CI were characterized by their volatile profile complexity, having the highest content of volatile compounds from the oak wood, terpenes and

C6 alcohols which provide pleasant woody, floral and herbaceous aromas. On the contrary, the RD wines were the richest in alcohol acetates responsible for fruity aromas.

According to the obtained results, other factors such as winemaking techniques used in the region and/or in the winery could have an influence on wine composition. Similar studies should be carried out including a larger number of sample wines, considering other variables, such as price and category, and evaluating sensory attributes to establish the relationship between compounds and sensory characteristics of the wines.

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