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Novel approach to red wine sensory evaluation

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Abstract

More sensory methods were employed in order to establish the sensory characteristics of five red wine assortments originating from two Romanian viticultural areas: Vrancea and Recaș. The sensory analysis of the wines was performed using a variety of methods such as scaling method, the method of describing the quality, the method of ordering by rank, "triangle" method and "duo-trio" method. By using more methods complimentary to each other, the analysed wines were assessed and classified according to their sensory characteristics and also to their typicality.

Keywords: aromatic olfactory profile, bouquet, flavour, taste, wine

1. Introduction

Natural wines are composed of 85−89% water, 10−14% ethylic alcohol, and organic acids that represent less than 1%. Other components are present in very small amounts and are responsible for the wine's aroma and flavour. The sensory attributes are among the most important factors for the analysis of a food product, because, the first contact of the consumer with the product is mediated through its sensory properties and, thus, they play a highly important role in the customer's decision to select a product [1]. The sensory impressions of the tasters require advanced discriminative and descriptive abilities that have been quantified statistically in previous studies [2-6]. Several studies investigated the cognitive and perceptual processes that characterize wine expertise [7]. Sensory analysis of wine consists of the assessment of attributes such as Limpidity, Taste, Color and Bouquet or Flavour; sensory analysis provides additional metrics that cannot be quantified by the analysis of physicochemical properties. Limpidity is a property required for fine and aged wines.

Taste is a measure of the intensity, quality, harmony among the components and degrees of wine softness.

The notion of bouquet describes the odor attribute in all its complexity, which is due to several odorous volatile compounds. A young wine has no bouquet yet and an aged wine has no flavour, but possesses the bouquet. The color of wine must match the type, assortment and age of the wine [2,3,4,5,6]. Aroma compounds play an important role in the quality of wine because they have an impact on the sensory senses. The aroma of the wine is due to aroma compounds present in wines (between 600 and 800 volatile components) [8]. Sensory analysis of wines has been applied in many scientific studies such as the influence of irrigation treatments on sensory attributes of the resulted wines (flavour, taste and aroma). Thus, a connection between vine water status and the differences in wine composition and sensory properties was established in literature [9]. During vinification, the sensory properties of wine can be adversely affected in ways such as loss of colour, flavour and aroma and, also, in the increase of astringency. In addition, the different vinification practices lead to changes in antioxidant compounds [10]. The main additive in oenology, used to prevent wine browning, is sulphur dioxide.

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The addition of SO_2 to wine can negatively influence wine quality. Used in excessive quantities, SO_2 can compromise the quality of wine and can confer unpleasing flavours and aromas.

The present paper introduces an extensive analysis of the sensory properties of 5 assortments of red wine (sweet, demi-sweet and demi-dry) originating from two Romanian viticultural areas, Vrancea and Recas.

2. Materials and methods

2.1. Wine samples: Five red wine studied wines originating from different wine regions of Romanian vineyards: Vrancea, located in the Moldavia area, in the eastern part of Romania, and, Recaș, located in Banat area, in the Middle-West part of Romania. The wines were codded as A-F:

A – "Fetească neagră" (Black Maiden) – red-demidry, originating from Vrancea area, table wine.

B - Cabernet Sauvignon - demisweet, from Recas. High quality wine

C - "Fetească neagră" (Black Maiden) - demisweet, grown in Vrancea, high quality wine.

D - Merlot/Pinot noir – demisweet, originating from Recas, high quality wine.

F - Merlot/Cabernet – sweet, from Vincon Vrancea, table wine.

The sensory analysis of the wines was performed using a variety of methods trying a better and complex understanding of the sensory qualities of red wines.

2.2. Methods of sensory analysis

***2.2.1. Scaling method*:** Sensory analysis by scaling method was performed on the 5 assortments of red wines (A, B, C, D and F). Based on the average score awarded by the panel of 5 tasters, the sensory quality of the wines was assessed at 15-17 ^oC by comparison with a scale of 20 points, according to Romanian Standard SR 13445/2001. It was assessed the overall quality of the wines by assigning 0 to 12 points for the taste profile, 0-4 points for aroma, and 0-2 points for color and limpidity (clarity).

2.2.2. The ordering by rank method: This sensory method consists in the receiving of the coded samples by the testers in a previously established sequence. The ordering by rank method can be applied to wine as follows: a series of samples is presented in order to classify them according to a certain sensory characteristic (astringency, in this case). This test by itself does not show the magnitude of the difference that can exist between samples. Tasters receive the coded samples simultaneously, in a particular order and arrange them according to the considered criterion. A minimum of 5 tasters is required.

***2.2.3. The method of describing the quality*:** This method is comprised of a systematic description of the flavour of tested samples and the assessment of the intensity of this attribute using grades. First, the tasters agree on the used attributes, and, for each attribute (10-40), a scale is used, where possible, following the reference standards. After testing the wine sample, the tasters give marks to quantify the attribute intensity; the results are then used to compute the sensory profile of the sample. The flavour profiles of two or more samples can be compared by using mathematical statistics. For this test at least 15 tasters (optimum 30) are required. A scale from 0 to 9 or 1 to 5 can be used.

***2.2.4. The triangle method*:** The triangle method consists of the distribution, to each taster, of three coded samples that were arranged in the all the possible combinations. Tasters receive the information and instruction: two of the samples are identical and one is different and they should select the unpaired sample. Eight tasters perform this task, each of them receiving a total of three coded samples, which were arranged into six possible combinations: XYY, YXX, XXY, YYX, XYX, YXY. The tasters were informed that two samples are identical and one is different; the examination must be done from left to right, and that they should select the unpaired sample. Tasters will complete a form with the identified or unidentified combination of samples. The triangle method has a limited use in the sensory assessing of wine due to the fact that tasters might experience sensory fatigue. The purpose of this method is the identification of the sample, by combining the five types of wine.

***2.2.5. Duo-trio method**:* This method consists in receiving the information from the tasters regarding the set of samples received by them and among these, one is a reference sample and the other is paired with the reference one. Tasters have to determine which of the two coded samples is paired with the reference sample. Between 5 and 9 tasters performed the sensory analysis according to the duo-trio method. The tasters are informed that they are given a set of samples which include a reference

sample and two coded samples, one of which is paired with the reference test. Additionally, they are informed that the tasting starts from the left and that the sample located on the left hand part is the reference one. From the randomly received combinations set, the taster must determine which of the two encoded samples is paired with the reference one, which is noted with an X. Tasters register the results in a form in which there is the following information "One of the two other samples is the same as the reference, and the other is different.

2.3. Data analysis*:* Statistical analysis of data were carried out using Excell facilities for the descriptive statistics and the Statgraphic program to establish which means of sensory attributes of the wines samples are significantly different.

3. Results and discussion

3.1. Sensory analysis of red wines by scaling method:The scaling method was employed to achieve tests aiming to quantify the sensory characteristics (Flavour, Taste, Color, Limpidity) of the 5 types of wines (A, B, C, D, F). For wine F all the tasters gave the maximum score for all the sensory characteristics.

This result might be due to the taste of wine F, it being the only sweet wine in the our series of wines.

It was found the largest variations of the scores, attributed by the tasters, in wines A and B. These types of wines also received the lowest scores. The scores for Flavour and Taste varied the most among the analyzed characteristics. Wines A and B obtained the lowest score at sensory analysis. Wines C and D received intermediate scores. For these wines, only low variations of the characteristics Flavour, Taste, Limpidity were registered, possibly due to their similar characteristics: both demisweet wines and of high quality, even derived from different viticultural areas: Vrancea and Recas.

The results of the sensory analysis of wines (Table 1) showed significant differences in wines analyzed for Taste. Wines C, D and F were highly appreciated and have obtained close scores in the range of 11.2-12.00 (maxim score for the Taste is 12). Another approach was based on the presentation of wines according to the scores obtained by computing the average scores awarded by the tasters, following the centralization of results (Fig 2a, Table 1)

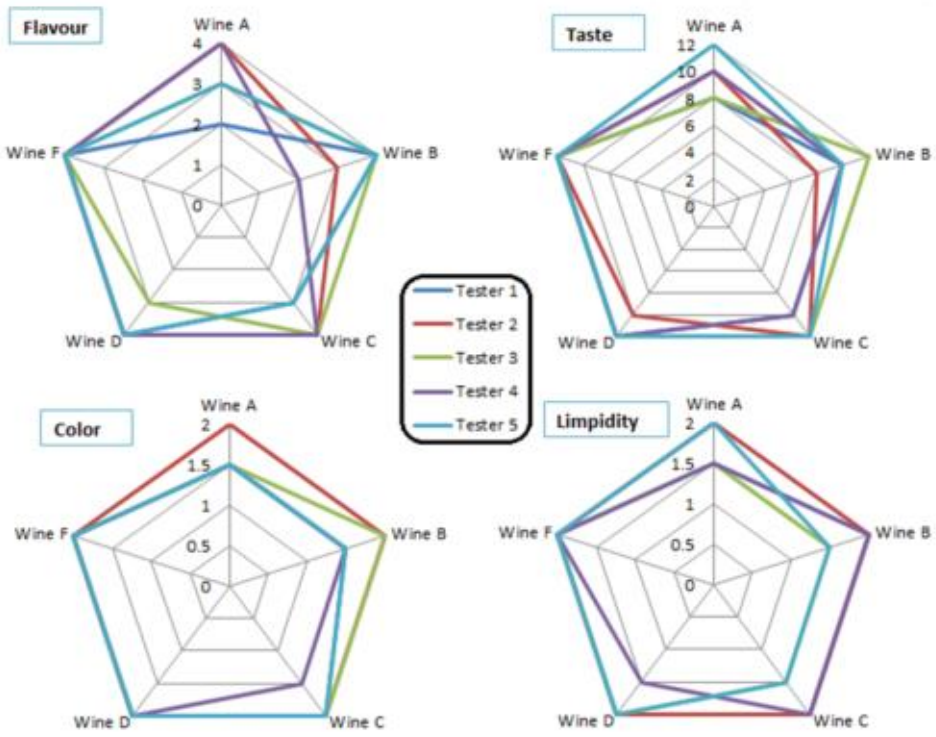

Figure 1. The sensory properties of the wines A, B, C, D, F for each taster

Table 1. Sensory analysis of wines by scaling method

Sensory attribute	Wine A	Wine B	Wine C	Wine D	Wine F
Color	1.60±0.22 a*	1.70±0.27ab	1.90±0.22b	2.00±0.00c	2.00±0.00c
Limpidity	1.70±0.27a	1.80±0.27a	1.80±0.27a	1.90±0.25a	2.00±0.00a
Taste	9.60±1.67a	10.00±1.41ab	11.20±0.97bc	11.60±0.89c	12.00±0.00c
Flavour	3.20±0.27a	3.40±0.89a	3.60±0.54a	3.80±0.44a	4.00±0.00a

Values are presented as means ± standard deviation
*Different letters within a line indicate significant differences for Fisher's LSD test and $p < 0.05$.

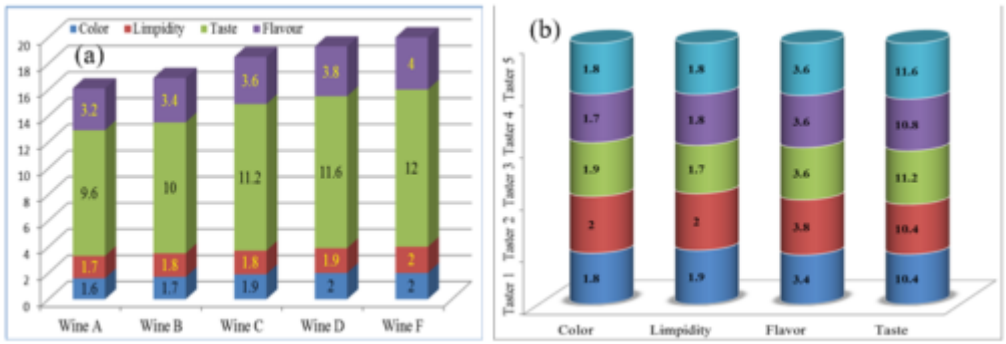

Figure 2. The results of sensory analysis of the wines a) sensory characteristics of the wines; b) average values of the sensory characteristics for each taster

Table 2. Sensory analysis of wine a) By rank ordering method (b), By simple descriptive method for describing quality combined with the method of profiling flavour

No.	Taster	**Intensity of astringency (a)**					**Method of profiling flavour (b)**				
		Wine code									
		1	*2*	*3*	*4*	*5*	*A*	*B*	*C*	*D*	*F*
		very strong	strong	moderate	week	very week	Number of awarded points (0-5)				
1	Taster 1	D	C	B	F	A	2	4	5	5	3
2	Taster 2	D	C	B	F	A	1	3	4	4	3
3	Taster 3	C	D	B	A	F	2	5	5	5	3
4	Taster 4	D	C	B	F	A	2	3	4	5	3
5	Taster 5	D	C	F	B	A	2	3	4	4	3
Majority		**D**	**C**	**B**	**F**	**A**					
Average score/ standard deviation							1.8±0.5a	3.6±0.9b	4.4±0.6c	4.6±0.6c	3±0b

Values are presented as means ± standard deviation
*Different letters within a line indicate significant differences for Fisher's LSD test and $p < 0.05$.

Table 3. Identifying combinations XYY, YXX, XXY, YYX, XYX, YXY, arranged in pairs of 2 types of wine

Combinations order	A-B	A-C	A-D	A-F	B-C	B-D	B-F	C-D	C-F	D-F
XYY	√	√	√	√	√	×	√	√	×	√
YXX	√	√	√	√	×	√	√	√	√	√
XXY	√	×	√	√	×	×	√	√	√	×
YYX	√	√	√	√	×	×	√	√	√	√
XYX	√	×	×	√	×	√	×	×	×	×
YXY	√	√	√	√	×	×	×	×	×	√

√ - identified sample; × - unidentified sample

In this case, it can be noted that wine F was assigned as the wine with the highest quality, the values of the obtained scores decreasing in the following sequence: F>D>C>B>A.

Interestingly, wine tasters highly appreciated an assortment of wine from Vrancea area but the tasters awarded the lowest score to another wine derived from the same area and, also, from the same winery.

This evaluation could be explained assuming that a wine can be appreciated in its sweet form but not endorsed in the form of semi-dry wine.

Figure 2b shows the variation of the average scores on each sensory characteristic of the wines according to each taster. In the case of Taste the values attributed are pretty close but for the others parameters the differences between the scores are relatively large. The highest variability among the wine assortments was for Color: 9.8 % and also for Taste (9.5%) while the low variability was found for Limpidity (6.2%).

3.2. Analysis of wine samples by the method of ordering by rank: Sensory analysis results are signed up in a form (Table 2a). The intensity of wine astringency was investigated by this method. After processing the data, it was found that the wine D has the strongest flavour, tangy, and corresponds to a high quality wine. Interestingly, wine F, is weak in terms of astringency, while in the score scale method it was declared as the best from the sensory point of view; on the other hand, the results about wine A are consistent across the two methods, as wine A retains its very weak character.

3.3. Simple descriptive analysis combined with the method of flavour profiling of wines: The results of individual tasters for the method of flavour profiling are summarized in a final report (Table 2b), where there are no significant discrepancies between tasters. In this case, wine D obtained the highest scores and wine A the lowest ones. Thus, wine D (of high quality) has the most intense flavour and corresponds to type and age. The flavour of the wine is formed during wine maturation.

3.4. Triangle method in the analysis of wines samples: By the triangle method (Table 3) we found that wine A is the most easily identifiable from all possible combinations in particular in combination with wine B or E.

The differences between the two wines can be given by the wine type, namely its variety. It seems that wine A was more easily identifiable relative to wine C, and, only in 2 of the 6 cases tested, it was not identified correctly.

In the case of the B-C combination, wines were identified only in one combination, which indicates that although they are both demisweet they come from two different geographical areas. In the C-F combination case, equality was found and the sample was identified in half of the cases.

3.5. ***Duo-trio method in the analysis of wine samples:***We created all 9 possible combinations of two tested samples by pairing the wines A, B, C, D, F (A-B, A-C, A-D, A-F, B-C, B-D, B-F, C-D, C-F); as reference we used one of the two analyzed wines. The samples were identified in 7 cases: A-B, A-C, A-D, A-F, B-F, C-D, C-F and were not identified in 3 cases: B-C, B-D and D-F. It is likely that with larger differences in class, variety, color, wines are easy to identify; harder to identify are wines from the same or similar categories such as demisweet wines and different variety of grapes (Feteasca neagra, Merlot/Pinot Noir or Cabernet Sauvignon). Dry wines are easy to differentiate from the sweet ones. The Duo-trio method has the advantage that the reference sample is presented without creating confusion. The disadvantage lies in the fact that the test is ineffective when the product leaves a pronounced aftertaste in the mouth.

Overall, our combination of the scaling sensory analysis with sorting methods (triangle method, duo-trio method) was powerful, as these methods were complementary to each other and allowed us to uncover additional information about sensory properties of wines as well as about their typicality.

4. Conclusions

Several sensory analysis methods were used to evaluate the sensory attributes of 5 assortments of Romanian wines originating from 2 viticultural areas: Vrancea and Recaș. Each sensory method gives useful and thorough information about the sensory attributes of the wine and, also, about its individuality and typicality. These methods of sensory analysis have been optimized through a novel, joint usage and detailed interpretation.

This study is very useful because it presents a comprehensive overview of red, sweet, semi-sweet, semi-dry wines in sensory analysis.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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