Ivana Alpeza[1], Katarina Rončević[2], Ivan Budimir[3] Original scientific paper

Adaptation of expert wine assessors to less familiar sensory testing methods without pretraining

Abstract
Wine sensory testing is carried out by assessors who are usually selected and prepared depending on the test type, and their skills may vary depending on various factors. Expert wine assessors should have superior sensory evaluation abilities, an expert grape and wine knowledge level but even more assessment competence. The aim of this research was to test the competencies of certified Croatian expert wine assessors using a less-familiar descriptive sensory methodology with no preliminary training. These assessors are highly educated in viticulture and/or enology and work in this sector. They have certified sensory skills and shorter or longer experience in sensory testing wines with Geographical indications. Twenty-three assessors participated in the study, and the results were segmented by gender and age. The testing was performed in a laboratory accredited by ISO/IEC 17025. Graševina and Zweigelt wines were tested, and two groups of attributes were analyzed (main quality attributes and specific aroma descriptors). Qualitative and quantitative statistics showed that expert wine assessors had a very similar approach in the choice of descriptors and the perception of their intensity. No difference was obtained in testing any attribute and descriptor, neither for any wine nor between segmented groups concerning age. A significant difference was observed only between women and men in their perception of the two specific aroma descriptors. The results confirmed that combining expert knowledge and experience based on professional education and continuous analytical work can replace a lack of experience in some less-familiar methods.
Keywords: *expert wine assessors, competencies, descriptive sensory evaluation*

Introduction

Wine assessors can be more or less involved in viticulture and enology and more or less competent (Parr et al., 2002). In general, it is possible to distinguish several levels of assessors, considering their sensory references, from naive to professionals and experts (ISO 8586, 2012). Different authors agree that there are differences in sensory skills among different groups of experts, whereby it is necessary to understand and distinguish wine experts from expert wine assessors (Ballester et al., 2008, Parr et al., 2011, Honoré-Chedozeau et al., 2020). Wine experts have skills to discriminate, recognize and describe different wines attributing these differences more to some knowledge of the product than to special sensory qualities (Hughson and Boakes, 2001, Royet et al., 2013), while expert wine assessors must have the level of grape and wine knowledge, but even more assessment competence: the focus on sensory expert assessors is on the consistency and repeatability across testing sessions. (Lesshaeve, 2007). Cadot et al. (2010) found that two panels, sensory experts and wine experts, who rated 24 Cabernet franc wines from different French Appellations, had a different perception of wine typicality and showed the relevance of the sensory expert panels in discriminating the products. Various authors describe wine expert as person with great knowledge in sensory wine testing; however, there are no official criteria and definition for wine expert accepted at the international level. This is probably one of the reasons for different expectations and research findings (Savela-Huovinen et al., 2018).

[1] dr. sc. Ivana Alpeza, Hrvatska agencija za poljoprivredu i hranu, Centar za vinogradarstvo, vinarstvo i uljarstvo (Croatian Agency for Agriculture and Food, Centre for Viticulture, Enology and Edible Oils), Jandrićeva 42, 10000 Zagreb, Croatia e-mail:
[2] Katarina Rončević, mag. ing. agr., Sveučilište u Zagrebu, Agronomski fakultet (University of Zagreb, Faculty of Agronomy), Svetošimunska cesta 25, 10000 Zagreb, Hrvatska
[3] doc. dr. sc. Ivan Budimir, Sveučilište u Zagrebu, Grafički fakultet (University of Zagreb, Faculty of Graphic Arts), Getaldićeva 2, 10000 Zagreb, Hrvatska
Autor za korespondenciju: ivana.alpeza@hapih.hr

According to ISO 8586 (2012), „an expert sensory assessor" is a selected assessor with a demonstrated sensory sensitivity and with considerable training and experience in sensory testing, who can make consistent and repeatable sensory assessments of various products". In terms of wine, it is based on long-term memory acquired during active work with wine and analytical work in the sensory field. These wine experts are also expert wine assessors who, with time and experience, unquestionably position themselves as the dominant authority concerning all existing levels of wine experts (Caley et al., 2014).

Sensory analysis are part of the certification procedures of products with Protected Designation of Origin (PDO), and these analysis are usually carried out by assessors trained and selected at the regional PDO or national level. In the case of wine and requirements concerning sensory wine testing, assessors should be very familiar with the different kinds of wine quality and with the parameters that participate in the creation of quality, ecological factors, grape varieties, and production technologies (Leriche et al., 2020). Despite that, there is no standardized approach for the sensory control for PDO wines (Perez-Elortondo et al., 2018). In any case, and regardless of the approach considered, an essential preliminary step is to describe the sensory characteristics and use appropriate terminology for the products to be controlled. The use of sensory evaluations in the certification of wines with Geographical indications (GIs) in Croatia is as old as the GIs system; the first label was approved in 1961. Since then, different methods have been used in sensory testing, while the main conditions for assessors have not changed much: academic education in viticulture and/or enology, work experience in the wine sector, sensory training, and in the last two decades, certified sensory competencies. These requirements are based on the analytical purpose; assessors should verify product compliance with corresponding PDO specifications and both qualitative and quantitative properties. Such conditions may limit the potential source for new assessors, but they ensure the professionalism and reliability of the results in sensory analysis (Alpeza et al., 2022). The objective level of the assessor's knowledge, the frequency of work in sensory testing, and the subjective workloads are different, and sensory testing always contains risk (Doty et al., 1985, Parr et al., 2002, Tempere et al. 2016). Despite that, expert assessors should present consensus and consistency of quality perception for a specific product, regardless of the method, and different authors presented it in the case of wine (Cadot et al., 2010, Grohmann et al., 2018).

Croatian expert wine assessors are well-trained in the „100-points" method and the simple descriptive method „Yes/no", and use them routinely and continuously. However, they are less familiar with other methods and have different and generally modest experiences. There is no paper on testing their competence in other sensory methods they do not commonly use and for which they are not explicitly trained, such as descriptive methods. Descriptive sensory analysis is widely studied and has evolved into a profoundly detailed and scientific approach (Lestringant et al., 2018). It is a sophisticated and powerful concept since it analyses the product's quantitative and qualitative aspects. The standard procedure includes vocabulary creation, education and selection of assessors, and the creation of a panel, mainly immediately before the testing. However, some fast methods without preliminary training, education, and selection of assessors are also known and in use (Djekic et al., 2021, Marques et al., 2022).

The aim of this research was to test the competencies of expert-certified wine assessors using non-familiar descriptive sensory analyses with no preliminary training. As already explained, these assessors have an academic education in viticulture and/or enology and certified sensory skills, as well as shorter or longer experience in wine sensory testing and specific methods. Therefore, the research included the segmentation of results concerning age. Gender is also known to have an influence on the sensory abilities: women are generally more sensitive to a wide range of odours in wine (Wurz et al.,. 2017), therefore, the gender is analysed as an potential factor of result difference.

Materials and methods

Twenty-three assessors participated in the research: aged between 35 and 63, 14 women and nine men. They were categorized into age groups: 34–49 years (early middle-aged adults, 9 participants) and 50–65 years (late middle-aged adults, 14 participants). These age cut-off points represent the life phases of the adult life span (Lachman, 2004) and the working life phases. The testing was carried out within two weeks in a national laboratory authorized for sensory testing of wine and fruit wines and accredited to ISO/IEC 17025. The technical condition, sample preparation, and analysis procedures were done following ISO 8589:2007. The testing was anonymous; the samples were coded and presented with information necessary for descriptive analysis (colour, variety, vintage). Two wines were analyzed, red Zweigelt (zone B) and white Graševina (zone C I), aged 20 months, with equal declared alcohol and sugar content.

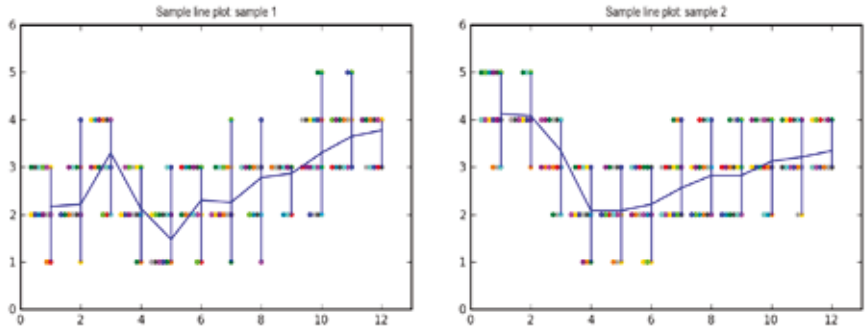
The descriptive method sheet was created in two parts. The first part described the main quality parameters with the same attributes for both wines; colour intensity and colour tint, aroma intensity: sweetness, acidity, astringency, alcohol perception, fullness (body), ripeness, taste harmony, and general impression (overall quality). The assessor could choose one of five offered descriptive attributes for each parameter. The second part of the test was a vocabulary of aroma with specific aromatic groups and specific descriptors of aroma: for white wine, fruity (citrus, green apple, peach, baked apple), herbal (fresh grass), floral and spicy (pepper), and for red wine fruity (cherry, sour cherry, plum, blueberry, dried fruit, jam), nutty (green walnut), floral, herbal, spicy, and wood aroma. The intensity of aromatic descriptors was ranked with Likert, from 1 (not pronounced) to 5 (very pronounced), and the assessor could choose one value.

Qualitative and quantitative statistical analysis was performed concerning individual attributes. The attributes from the first part of testing were transformed into numerical values from 1 to 5. Various descriptive parameters that describe the results and their conformity, i.e., dispersion, were analyzed: median, mod, interquartile range, robust standard deviation, relative coefficient of variation, and higher and lower confidence interval. The one-way ANOVA was used to test the differences between assessors in the first group of attributes. Nonparametric Mann-Whitney U-test was applied to test the differences between segmented groups (gender and age).

The data were analyzed in Microsoft Excel, 2017 (Microsoft Office, Redmond, WA, USA), in PanelCheck software (www.panelcheck.com), and Statistica, version 12.0 (TIBCO/StatSoft, Tulsa, USA).

Results and discussion

Main descriptive quality parameters



Footnotes: sample 1: white wine Graševina; sample 2: red wine Zweigelt. Horizontal axis: 1: color intensity, 2: color tint, 3: aroma intensity, 4: sweetness, 5: astringency, 6: acidity, 7: alcohol, 8: extract, 9: maturity, 10: taste harmony, 11: aging potential, 12: overall quality. Vertical axis: values 1-6 are descriptors transformed in numbers.

Graph 1. Key quality parameters: Line plot focusing on assessors agreement

Grafikon 1. Glavni parametri kakvoće: "Line plot" s naglaskom na slaganje ocjenjivača

Line plot (Graph 1.) visualizes the data in two ways: all attributes are displayed with scores of all assessors, and the line connecting the points indicates the panel average scores for each attribute. With this line, it is possible to identify how well the assessors agree with each other. It was possible to choose one descriptor of five for each attribute, and the numbers 1-5 follow different descriptors depending on the attribute. Ideally, the range should be as small as possible, meaning that the assessors agree well. Most of the selected answers of most parameters are within three out of five possible and concentrated on two descriptors with similar qualitative meanings. There are very few deviations beyond the two most frequently chosen descriptors. This plot with circles within the range can indicate assessors who contribute to a wide scoring range (Tomic et al., 2010). It seems that assessors pointed with blue and green grass colours contribute to the wide scoring range related to sample 1 and to a biased panel average for some attributes. This presentation is an excellent example to explain why to use the median as a more objective mean. This graphic is also a valuable tool to help in further analyses and making conclusions about the necessary training of the assessor or panel.

The one-way ANOVA was used to test the differences between the results and assessors, and no significant difference was found. Few individual results that affected the large range of results, as observed in the line plot (Graph 1.), did not affect the reliability of the results.

Table 1. General quality parameters: descriptive statistics
Tablica 1. Opći parametri kakvoće: deskriptivna statistika

	CI	CT	AI	SW	AST	ACI	ALC	EX	MAT	TH	AGE	OQ
White wine												
MED	2	2	3	2	1	2	2	3	3	3	4	4
MOD	2	2	3	2	1	2	2	3	3	3	4	4
IQR	0,5	0	1	0	1	1	0,5	0	0	1	1	0
s	0,1	0	0,2	0	0,2	0,2	0,1	0	0	0,2	0,2	0
CVr	5	0	6	0	19	10	5	0	0	6	5	0
Ic sup	2,2	2	3,4	2	1,4	2,4	2,2	3	3	3,4	4,4	4
Ic inf	1,8	2	2,6	2	0,6	1,6	1,8	3	3	2,6	3,6	4
Red wine												
MED	4	4	**3**	2	2	2	2	3	3	3	3	3
MOD	4	4	**4**	2	2	2	2	3	3	3	3	3
IQR	0,5	0	1	0	1	1	1	1	1	0,5	1	1
s	0,1	0	0,2	0	0	0,2	0,2	0,2	0,2	0,1	0,2	0,2
CVr	2	0	6	0	0	10	10	6	6	3	6	6
Ic sup	4,2	4	3,4	2	2	2,4	2,4	3,4	3,4	3,2	3,4	3,4
Ic inf	3,8	4	2,6	2	2	1,6	1,6	2,6	2,6	2,8	2,6	2,6

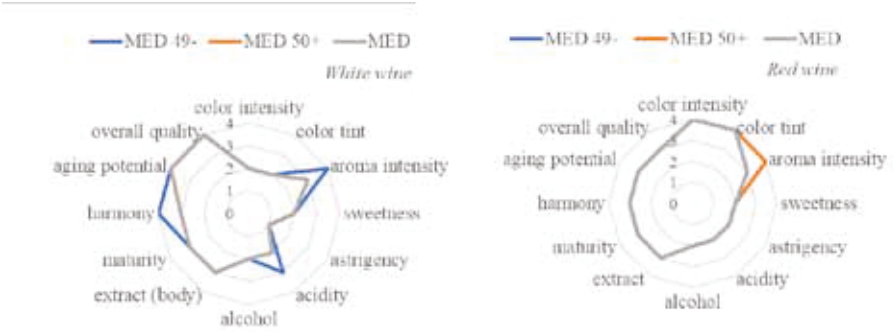
Footnotes: CI: color intensity; CT: color tint; AI: aroma intensity; SW: sweetness; AST: astringency; ACI: acidity; ALC: acidity; EX: extract; MAT: maturity; TH: taste harmony; AGE: aging, OQ: overall quality, MED: median, ICQ: interquartile range, s: robust standard deviation, CVr: relative coefficient of variation (%), Ic sup: higher confidence interval, Ic inf: lower confidence interval.

Although the median is generally used as the mean in similar testing, in this analysis, the mod was also considered. The mod is the value that appears most often, and is determined by the frequency of the results: it is an indicator of the perception of the largest group of assessors, not the majority of assessors. Differences between these mean values arise from the assessor's compliance in choosing descriptors. The difference is observed only in the red wine aroma intensity perception. The robust standard deviation includes all results. In this case, given the small range of differences and the possibility of the appearance of "outlier" values, it is a more objective indicator of deviation. The coefficient of variation (CVr) is a statistical measure of the relative dispersion of values in a series of data around the mean value, expressed in %, and attribute intensity evaluations are valid if the robust coefficient of variation (CVr %) of judgments is ≤20.0%. It is observed that CVr values for all parameters fall within the validity range (Table 1.). The CVr value for the astringency of white wine is very close to the upper limit, representing the least assessors' agreement. For all other parameters, the CVr values are far from the limitations and were in the range of 0-10%. The values of confidence intervals can be used as an objective assessment of (in)accuracy and sample size and are relatively narrow considering the used scale. It can be concluded that the sample and the study were representative.

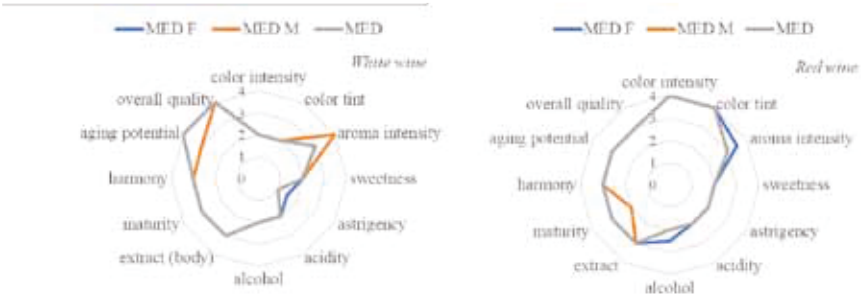
The comparisons of the first group of descriptors and their perception related to assessors age and gender are shown in Graph 2. and Graph 3. Overlapping lines indicate compliance between groups. It seems that early middle-aged assessors perceived aroma intensity (smell), acidity (taste), and harmony (taste) of white wine more intensively than late middle-aged, while late middle-aged experienced aroma intensity of red wine more intensively (Graph 2.). Graphical presentation of gender segmentation indicates some differences between women and men. They disagree about aroma intensity and aging potential perception of white wine and the maturity of red wine. Other differences in astringency, alcohol and aroma intensity perception arise from the median of odd number of results in the segmented group. The aroma intensity could be extracted as an attribute of conflict because age and gender-segmented groups differ in expression of its perception.

The nonparametric Man-Whitney test was used to analyse the differences between the results and assessors, and was used due to the relatively small number of assessors and ordinal data distribution. No significant difference between key quality attributes perception related to gender or age was found.

It can be concluded that the assessors are fully aligned about the first group of quality attributes, regardless of gender and age.



Graph 2. Assessors age segmentation of key quality parameters perception.
Grafikon 2. Percepcija najvažnijih parametara kakvoće u odnosu na dob ocjenjivača.



Graph 3. Assessors gender segmentation of key quality parameters perception.
Grafikon 3. Percepcija najvažnijih parametara kakvoće u odnosu na spol ocjenjivača.

Aroma profile descriptors

Sensory aroma profiling was a more demanding part of testing because most of the assessors who participated in this study had very little experience in this method. Therefore, it was a challenge to test whether expert professional knowledge and sensory competencies could compensate for the lack of experience with this specific method.

Table 2. Aroma descriptors of white wine: descriptive statistics
Tablica 2. Deskriptori arome bijelog vina: deskriptivna statistika

	Citrus fruits	Green apple	Peach	Baked apple	Floral aroma	Fresh grass	Exotic fruit	Pepper
MED	2	**3**	2	**2**	**2**	**2**	1	1
MOD	2	**4**	2	**1**	**3**	**1**	1	1
IQR	0	1,5	1	2	1,5	1	0	0
s	0	0,3	0,2	0,4	0,3	0,2	0	0
CVr	0	10	10	19	14	10	0	0
Ic sup	2	3,6	2,4	2,8	2,6	2,4	1	1
Ic inf	2	2,4	1,6	1,2	1,4	1,6	1	1

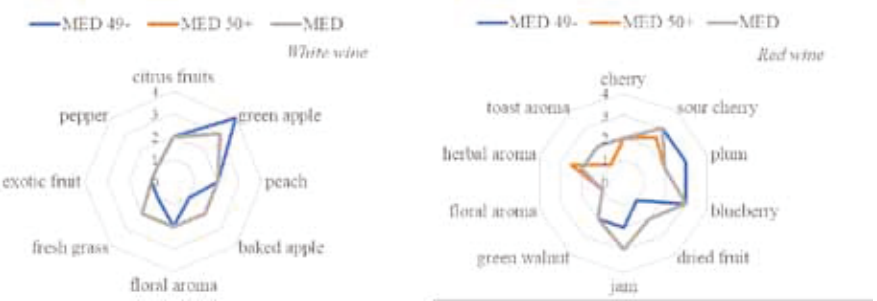
Footnotes: MED: median, ICQ: interquartile range, s: robust standard deviation, CVr: relative coefficient of variation (%), Ic sup: higher confidence interval, Ic inf: lower confidence interval

Table 3. Aroma descriptors of red wine: descriptive statistics
Tablica 3. Deskriptori arome crnog vina: deskriptivna statistika

	Cherry	Sour cherry	Plum	Blueberry	Dried fruit	Jam	Green walnut	Floral aroma	Herbal aroma	Toast aroma
MED	2	3	2	3	**2**	3	2	1	2	**2**
MOD	2	3	2	3	**1**	3	2	1	2	**1**
IQR	1	1	1	0,5	2	1,5	1,5	1	1	1
s	0,2	0,2	0,2	0,1	0,4	0,3	0,3	0,2	0,2	0,2
CVr	10	6	10	3	19	10	14	19	10	10
Ic sup	2,4	3,4	2,4	3,2	2,8	3,6	2,6	1,4	2,4	2,4
Ic inf	1,6	2,6	1,6	2,8	1,2	2,4	1,4	0,6	1,6	1,6

Footnotes: MED: median, ICQ: interquartile range, s: robust standard deviation, CVr: relative coefficient of variation (%), Ic sup: higher confidence interval, Ic inf: lower confidence interval

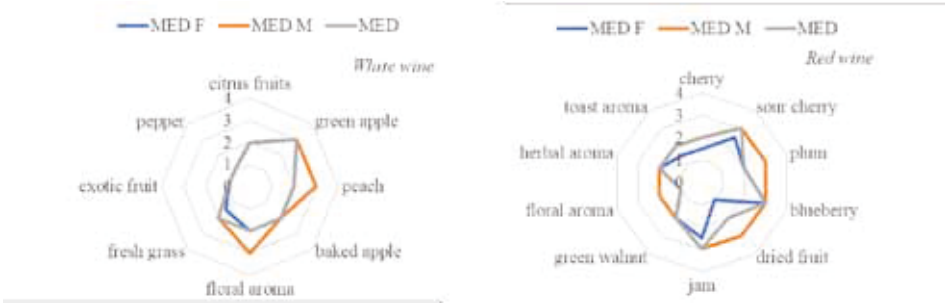
The expressiveness of specific aroma descriptors was evaluated with a Likert scale, from 1 (weakly pronounced) to 5 (very pronounced). The values of descriptive statistical indicators of relative dispersion are in correlation with variation in results: robust standard deviation (s), coefficient of variation (CVR, %), and confidence intervals point to a good agreement between assessors (Table 2., Table 3.). The difference between the median and mod was noted in the perception of white wine aroma of green apple, baked apple, fresh grass, and floral scent (Table 2) and in the perception of red wine aroma of dried fruit and toast (Table 3.). CVR values are within the confidence interval (less than 20%), but some higher values are noticeable than for the first group of attributes (Table 1.).



Note: MED: Sample Median

Graph 4. Assessor age segmentation of aroma descriptors perception

Grafikon 4. Percepcija deskriptora arome u odnosu na dob ocjenjivača



Note: MED: Sample results Median. M: Male, F: Female.

Graph 5. Assessor gender segmentation of aroma descriptors perception

Grafikon 5. Percepcija deskriptora arome u odnosu na spol ocjenjivača

The discrepancy between age and gender groups regarding the average values of the expression of aromatic descriptors was almost minor (Graph 4., Graph 5.). Assessors from the "49-" group experienced green apple aroma more intensive and baked apple and fresh grass aroma less intensive. At the same time, assessors from the late middle-aged adult group completely agreed about the white wine aroma. In the case of red wine, late middle-aged adults had three, and early middle-aged adults had one deviation out of ten possible. Gender segmentation showed that women and men have a similar understanding of aroma profiling, with one difference in white wine aroma and two deviations in red wine aroma. Men perceived plum and dried fruits' aroma more intensively than women. Women perceived cherry and

cooked fruit aromas in red wine to be less pronounced and the floral scent of red wine more intense, but slightly. On the other hand, women experienced the floral aroma in white wine as more intense and the dried fruit and baked apple aroma as less severe. However, the observed differences are not a source of unreliable results, and it was clear after the quantitative statistic was done. There was no significant difference between the results and segmented age groups of assessors in aroma perception. According to Mann-Whitney U-tests, only two aroma descriptors were the source of considerable differences and they are related to gender segmentation (Table 4.).

Table 4. Aroma descriptors that differ significantly concerning gender: Man-Whitney U-test
Tablica 4. Deskriptori arome značajno različiti u odnosu na spol: Man-Whitney U-test

	Number of assessors		Sum of ranges		Statistics		
	M	F	M	F	U	Z	p-value
Floral aroma/white wine	14	9	158	118	13,00	3,12	0,001820
Dried fruits aroma/red wine	14	9	146	130	25,00	2,36	0,018164

Note: M: Male; F: Female. Significance level of $p<0.05$

Although grape variety was not the focus of the study, it was possible to analyze the influence of variety on the perception of attributes. Zweigelt is a variety whose wines are traditionally light-bodied, contain very little tannin, and have relatively high acidity. The aroma profile of the wine is characterized by berries: cherries, raspberries, and black currant notes. Secondary notes may include spicy cinnamon, pepper, and a floral aroma (https://wineparadigm.com/zweigelt/). The Graševina wines in the C I zone are well-structured, light greenish with yellow reflection, pleasant freshness, gentle bitterness, and a dominant fruity aroma of green apple, vineyard peach, and delicate floral scents (Herjavec, 2019). Graševina is the most important white variety, while Zweigelt has a minor position in Croatian wine production, which means assessors have a very different experience in sensory analyses of these varieties. However, it did not influence assessors, and observed differences in the expression of some aromatic attributes are insignificant (Table 1., Table 2., Table 3.). The aroma vocabulary offered some descriptors that are non-typical to the Graševina variety, such as aroma of pepper and aroma of exotic fruits. It can be discussed as a "trick" question thus allowing an additional level of assessor control because participants were not informed on that. It did not confuse assessors and influence their self-confidence , which could affect the quality of work and results (Table 2., Table 3.).

The assessors in this study have similar backgrounds: professional education, sensory training, testing, certification, and experience with wine. The results confirmed that when assessors have recognizable and common references, their mental representation of wines is similar and consistent, as other authors found (Otheguy et al., 2021). This research has shown that the conditions for achieving and maintaining expert status are knowledge, experience, and a clear and implemented concept of education. The results showed how a common background of education and training could compensate for the different experiences of assessors within the panel. Experience alone, without continuous professional training, can result in knowledge and confidence but not mental representation. As already mentioned, expert knowledge is acquired through experience, and in the case of expert assessors, continuous education and training. Gawel (1997) suggested that, concerning knowledge and training, better performances result from standardized and directed education programs. In the case of knowledge and experience, it relates to passive exposure to a wide variety of stimuli, which makes them more familiar.

The quality of the measuring instrument is determined by the performances that produce a reliable result. An assessor can be explained as a part of an instrument when he is a part of the panel (ISO 8586, 2012). It means that the sensory panel is an accurate measuring instrument because it utilizes human sensory perceptions as instrumental measures to quantify the sensory features of products (Sipos et al., 2021). Objective knowledge about varieties and wine, different ecological conditions, and specific technologies should be the basis for the selection and randomization of assessors. This research analyzed them as assessor-instrument, considering their references.

Furthermore, apart from the knowledge, the panel should contain enough members to minimize variability in results; however, smaller but highly trained and experienced panels can be more reliable than panels with more members who are less trained (De Vos, 2010). The results of descriptive statistics (Table 1. and Table 2.) present both the quality of the samples and, indirectly, the quality of the study. The number of assessors included in the study is more than double related to recommended for the descriptive sensory methods panel. A panel of 10 to 12 assessors is recommended, but the panel's expertise can reduce the number of assessors required for the descriptive test (Simiqueli et al., 2015).

This study can be helpful in the future development and modification of the sensory method for the control of PDO wines. As previously discussed, the problem of PDO wines needs to be more detailed described, and the training and selection of wine assessors is a part of these activities (Gomis-Bellmunt et al., 2022). However, the process of performing sensory descriptive analysis is time consuming and expensive, as participants must be screened and trained, which can take months (Lawless and Heymann, 2010). In the case of Croatian expert assessors, we presented that they can successfully participate in the description and preparation of vocabulary of different PDO wines. They demonstrated knowledge and sensory skills that can reduce the selection protocols and training of assessors in specific sensory testing.

Conclusions

This research showed that expert wine assessors with viticulture and enology professional education, who work in the viticulture and enology sector, with confirmed sensory abilities, and who continuously participate in sensory testing could adapt to different methods of sensory analyses and produce reliable results without pretraining. The results confirmed that combining expert knowledge and experience based on professional education, professional work, and training can replace a lack of experience in some specific method. Thanks to the findings of this study, assessors' selection protocols and training programs in specific descriptive sensory wine testing could be simplified when wine expert assessors are the testers.

Literatura

Alpeza, I., Linke, I., Runje, B. (2022) How to improve the monitoring of subjective analytical methods and assessors – the case of wine. *Tehnički glasnik – Technical journal*, 16 (4), 530-536. DOI: 10.31803/tg-20220116105138

Ballester, J., Patris, B., Symoneaux, R., Valentin, D. (2008) Conceptual vs. perceptual wine spaces: Does expertise matter? *Food Quaity,* (19), 267–276. DOI: 10.1016/j.foodqual.2007.08.001.

Cadot, Y., Caillé, S., Samson, A., Barbeau, G., Cheynier, V. (2010) Sensory dimension of wine typicality related to a terroir by Quantitative Descriptive Analysis, Just About Right analysis and typicality assessment. *Analytica Chimica Acta*. 660 (1-2), 53-62. DOI: 10.1016/j.aca.2009.10.006

Caley, M. J.; O'Leary, R.; Fisher, R.; Low-Choy, S.; Johnson, S., Mengersen, K. (2014) What is an expert? A systems perspective on expertise. Ecology and Evolution 4(3), 231–242. DOI: 10.1002/ece3.926

De Vos, E. (2010) Selection and management of staff for sensory quality control. Kilcast, D. (ed.) In: Kilcast, D., ed. *Sensory analysis for food and beverage quality control.* Cambridge: Woodhead Publishing Limited.

Djekic, I., Lorenzo, J.M., Munekata, P.E.S., Gagaoua, M., Tomasevic, I. (2021) Review on Characteristics of Trained Sensory Panels in Food Science. *Journal of Texture Studies*, *52* (4), 501–509. DOI: 10.1111/jtxs.12616

Doty, R. L., Applebaum, S., Zusho, H., Settle, R. G. (1985) Sex differences in odor identification ability: A cross-cultural analysis. *Neuropsychologia*, 23 (5), 667-672. DOI: 10.1016/0028-3932(85)90067-3

Gawel, R. (1997) The use of language by trained and untrained experienced wine tasters. *Journal of Sensory Studi-*

es, 12, 267–284. DOI: 10.1111/j.1745-459X.1997.tb00067.x

Gomis-Bellmunt, A., Claret, A., Puig-Pujol, A., Pérez-Elortondo, F. J, Guerrero, L. (2022) Development of a Descriptive Profile and References for the Assessment of Taste and Mouthfeel Descriptors of Protected Designation of Origin Wines. *Foods*, 11 (19), 2970. DOI: 10.3390/foods11192970

Grohmann, B., Peña, C., Joy, A. (2018) Wine quality and sensory assessments: do distinct local groups of wine experts differ? *Journal of Wine Research,* 29 (4), 278-289. DOI: 10.1080/09571264.2018.1532882

Hedozeau, H. C., Ballester, J., Chatelet, B., Lempereur, V. (2015) Wine competition: From between-juries consistency to sensory perception of consumers. *BIO Web of Conferences*, *5*, 03009–03015. DOI: 10.1051/bioconf/20150503009

Herjavec, S. (2019*) Vinarstvo*. Nakladni zavod Globus. Zagreb. 128-177

Honoré-Chedozeau, C., Chollet, S., Lelièvre-Desmas, M., Ballester, J., Valentin, D. (2020) From perceptual to conceptual categorization of wines: What is the effect of expertise? *Food Quality and Preference*, 80. DOI: 10.1016/j.foodqual.2019.103806

Hughson, A. L., Boakes, R. A. (2001) Perceptual and cognitive aspects of wine experts. *Australian Journal of Psychology,* 53(2), 103–108. DOI: 10.1080/00049530108255130

Hughson, A. L., Boakes, R. A. (2002) The knowing nose: The role of knowledge in wine expertise. *Food Quality and Preference*, 13 (7), 463–472. DOI: 10.1016/S0950-3293(02)00051-4

Hughson, A. L., Boakes, R. A. (2001) Perceptual and cognitive aspects of wine expertise. *Australian Journal of Psychology*, 53 (2), 103-108. DOI: 10.1080/00049530108255130

ISO 8586:2012 (2012) Sensory analysis — General guidelines for the selection, training and monitoring of selected assessors and expert sensory assessors. International Organization for Standardization. Geneva. Switzerland.

ISO 8589:2007 (2007) Sensory analysis — General guidance for the design of test rooms. International Organization for Standardization. Geneva. Switzerland.

ISO/IEC 17025:2017 (2017) General requirements for the competence of testing and calibration laboratories. Geneva. Switzerland.

Lachman, M. E., Teshale, S., Agrigoroaei, S. (2015) Midlife as a pivotal period in the life course: Balancing growth and decline at the crossroads of youth and old age. *International Journal of Behavioral Development*, 39 (1), 20–31. DOI: 10.1177/0165025414533223

Lachman, M.E., (2004) Development in Midlife. *Annual Review of Psychology,* 55 (1), 305-331. DOI: 10.1146/annurev.psych.55.090902.141521

Lawless, H. T., Heymann, H. (2010) *Sensory Evaluation of Food: Principles and Practices*. 2nd ed. New York: Springer.

Leriche, C., Molinier, C., Razungles, A., Symoneaux, R., Coulon-Leroy, C. (2020) Development of a methodology to study typicity of PDO wines with professionals of the wine sector. *Journal of the Science of Food and Agriculture,* 100 (10), 3866-3877. DOI: 10.1002/jsfa.10428

Lesschaeve, I. (2007) Sensory evaluation of wine and commercial realities: Review of current practices and perspectives. *American Journal of Enology and Viticulture*, 58 (2), 252- 258.

Lestringant P., Delarue J., Heymann H. (2018) How have conventional descriptive analysis methods really been used? A systematic review of publications. *Food Quality Preference.* (71) 1-7. DOI: 10.1016/j.foodqual.2018.05.011.

Marques, C., Correia, E., Dinis, L.-T., Vilela, A. (2022) An Overview of Sensory Characterization Techniques: From Classical Descriptive Analysis to the Emergence of Novel Profiling Methods. *Foods*, 11 (3), 255. DOI: 10.3390/foods11030255

Otheguy, M., Honoré-Chedozeau, C., Valentin, D. (2021) Do wine experts share the same mental representation? A drawing elicitation study with wine makers, sellers, and critics. Food Quality and Preferences. 94, 104302. DOI: 10.1016/j.foodqual.2021.104302

Parr, W. V., Heatherbell,D. K., White, G. (2002) Demystifying Wine Expertise: Olfactory Threshold, Perceptual Skill and Semantic Memory in Expert and Novice Wine Judges. *Chemical Senses*, 27 (8), 747–755. DOI: 10.1093/chemse/27.8.747

Parr, W. V., Valentin, D., Green, J. A., Dacremont, C. (2010) Evaluation of French and New Zealand Sauvignon wines by experienced French wine assessors. *Food Quality and Preference*, 21 (1), 56–64. DOI: 10.1016/j.foodqual.2009.08.002

Parr, W.V., Mouret, M., Blackmore, S., Pelquest-Hunt, T., Urdapilleta, I. (2011) Representation of complexity in wine: Influence of expertise. *Food Quality and Preference*, 22 (7), 647–660. DOI: 10.1016/j.foodqual.2011.04.005

Pérez-Elortondo, F. J., Symoneaux, R., Etaio, I., Coulon-Leroy, C., Maître, I., Zannoni, M. (2018) Current Status and Perspectives of the Official Sensory Control Methods in Protected Designation of Origin Food Products and Wines. *Food Control,* 88, 159–168. DOI: 10.1016/j.foodcont.2018.01.010

Royet, J. P., Plailly, J., Saive, A.L., Veyrac, A., Delon-Martin C. (2013) The impact of expertise in olfaction. *Frontiers in Psychology*, (4) 928. DOI:10.3389/fpsyg.2013.00928

Savela-Huovinen, U., Muukkonen, H., Toom A. (2018) Sensory expert assessor's learning practices at workplace: competencies and contexts in sensory evaluation. *Journal of Sensory Studies*, 33 (2), 1- 10. DOI: 10.1111/joss.12315

Simiqueli, A. A., Minim, V. P. R., da Silva, R. C. S. N., da Silva, A. N., Minim, L.A. (2015) How many assessors are necessary for the Optimized Descriptive Profile when associated with training?, *Food Quality and Preference*, 44, 62-69. DOI: 10.1016/j.foodqual.2015.03.019

Sipos, L., Nytrai, A., Hitka, G., Friedrich, L. F., Kókai, Z. (2021) Sensory Panel Performance Evaluation—Comprehensive Review of Practical Approaches. *Applied Sciences*, 11 (24), 11977. DOI: 10.3390/app112411977

Tempere, S., Hamtat, M.-L., de Revel, G., Sicard, G. (2016) Comparison of the ability of wine experts and novices to identify odorant signals: a new insight in wine expertise. *Australian Journal of Grape and Wine Research*, 22 (2), 190–196. DOI: 10.1111/ajgw.12192.

Tomic, O., Luciano, G., Nilsen, A., Hyldig, G., Lorensen, K., Næs, T. (2010) Analysing sensory panel performance in proficiency tests using the PanelCheck software. *European Food Research and Technology,* (230) 497 – 511. DOI: 10.1007/s00217-009-1185-y

Wurz, D.A., Allebrandt, R., Pereira de Bem, B., Bonin, B., Reinehr, J., Tamiris Canossa, A., Rufato, L., & Kretzschmar, A., 2017. Women have better olfactory perception for wine aromas. BIO Web Conf. 9, 04005. http://www.bio-conferences.org/10.1051/bioconf/20170904005

Prispjelo/Received: 16.11.2022. Prihvaćeno/Accepted: 29.11.2022.

Izvorni znanstveni rad

Prilagodba ekspertnih ocjenjivača vina manje poznatim metodama senzornih ispitivanja bez prethodne pripreme

Sažetak

Senzorna ispitivanja vina provode ocjenjivači koje se obično bira i priprema sukladno metodi ispitivanja i njihove vještine mogu varirati ovisno o različitim čimbenicima. Ekspertne ocjenjivače vina definiraju vrhunske sposobnosti senzornih ocjenjivanja, ekspertnu razinu znanja o grožđu i vinu, ali još više analitičke senzorne kompetencije. Cilj ovog rada bio je ispitati kompetencije ovlaštenih hrvatskih ekspertnih ocjenjivača vina primjenom manje poznate deskriptivne senzorne metodologije i bez prethodne obuke. Ovi ocjenjivači su visokoobrazovani u vinogradarstvu i/ili vinarstvu i rade u ovom sektoru. Certificiranih su senzornih sposobnosti, uz kraće ili duže iskustvo u senzornim ispitivanjima vina s oznakom zemljopisnog podrijetla. U istraživanju su sudjelovala 23 ocjenjivača, a rezultati su segmentirani prema spolu i dobi. Ispitivanje je obavljeno u laboratoriju akreditiranom prema ISO/IEC 17025. Testirana su vina sorata Graševina i Zweigelt, a analizirane su dvije grupe parametara (glavna svojstva kvalitete i specifični aromatski deskriptori). Kvalitativna i kvantitativna statistička analiza pokazala je da su ekspertni ocjenjivači vina s predočenim referencama imali vrlo sličan pristup u izboru deskriptora i percepciji njihovog intenziteta. Nije dobivena razlika između rezultata u testiranju bilo kojeg atributa i deskriptora, ni za bilo koje vino općenito, niti između segmentiranih grupa ocjenjivača obzirom na dob. Jedina značajna razlika dobivena je između žena i muškaraca u percepciji dva deskriptora arome. Rezultati su potvrdili da se kombinacijom ekspertnog znanja i iskustva temeljenog na stručnom obrazovanju i kontinuiranom analitičkom radu može nadomjestiti nedostatak iskustva u radu s manje poznatom metodom.

Ključne riječi: *ekspertni ocjenjivači vina, kompetencije, deskriptivna senzorika*