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Comparison of rapid descriptive sensory methodologies: Free-Choice Profiling, Flash Profile and modified Flash Profile

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ABSTRACT

Rapid sensory methods have been developed as alternatives to traditional sensory descriptive analysis methods. Among them, Free-Choice Profiling (FCP) and Flash Profile (FP) are two that have been known for many years. The objectives of this work were to compare the rating-based FCP and ranking-based FP method; to evaluate the impact of adding adjustments to FP approach; to investigate the influence of the number of assessors on the outcome of modified FP. To achieve these aims, a conventional descriptive analysis (DA), FCP, FP and a modified version of FP were carried out. Red wines made by different grape maturity and ethanol concentration were used for sensory testing. This study showed that DA provided a more detailed and accurate information on products through a quantitative measure of the intensity of sensory attributes than FCP and FP. However, the panel hours for conducting DA were higher than that for rapid methods, and FP was even able to separate the samples to a higher degree than DA. When comparing FCP and FP, this study showed that the ranking-based FP provided a clearer separation of samples than rating-based FCP, but the latter was an easier task for most assessors. When restricting assessors on their use of attributes in FP, the sample space became clearer and the ranking task was simplified. The FP protocol with restricted attribute sets seems to be a promising approach for efficient screening of sensory properties in wine. When increasing the number of assessors from 10 to 20 for conducting the modified FP, the outcome tended to be slightly more stable, however, one should consider the degree of panel training when deciding the optimal number of assessors for conducting FP.

1. Introduction

Descriptive sensory profiling has been commonly used to describe sensory characteristics of food products. The conventional descriptive analysis (DA) as described by Lawless and Heymann (2010) is the most widely applied sensory profiling method. It provides detailed information of products with reliable and consistent results. However, there are some implications using this test: (i) the longer time needed to obtain results due to the need of panellist training, and (ii) the importance to obtain consensus on particular attributes, which sometimes induces a difficult task when working with expert judges like wine professionals or chefs (Hopfer & Heymann, 2013). Alternatively, faster methods have been introduced in both scientific research and industry; Free-Choice Profiling (Williams & Langron, 1984) and Flash Profile (Dairou & Sieffermann, 2002; Sieffermann, 2000) are two of them.

Free-Choice Profiling (FCP) was first applied in a study on commercial wines that illustrated there was no need to use precisely defined sensory descriptors to describe products. In FCP, each assessor produces individual profiles of the products, using his or her own terms for describing them without the need to explain the meaning of such terms. The spatial configurations derived from individual profiles are rationalised by Generalised Procrustes Analysis. The result is a consensus configuration revealing the interrelationships between the samples for the panel as a whole (Williams & Langron, 1984). Flash Profile (FP), developed as a variant of FCP, is an original combination of free-choice terms selection with a ranking method based on simultaneous presentation of the whole product set. This method also does not impose a common vocabulary on the subjects. Furthermore, the assessors are not asked to rate samples but instead to rank samples for each attribute. Both FCP and FP methods have been used in sensory evaluation in

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many different food product categories. However, there have been few studies working on comparing the ranking-based and rating-based rapid methods. Therefore, the first aim of the present work was to compare FCP and FP, and results have been compared to the conventional descriptive analysis.

Another aim of this work was to explore adding adjustments to existing rapid protocols to improve results. A big difference between the conventional descriptive analysis and rapid sensory methods is the training time. Increased training of the descriptive sensory panel allows for obtaining more detailed, accurate, reproducible and stable results over time. Thus, additional training of panels conducting rapid sensory might reduce the difference in results obtained by conventional descriptive analysis and rapid sensory methods. Modifications to the classical FP approach were proposed in previous work by Liu, Grønbeck, Di Monaco, Giacalone, and Bredie (2016) and have been recently applied in evaluating yogurts, white wines and rosé wines (Liu, Arneborg, Toldam-Andersen, Petersen, & Bredie, 2017; Liu, Arneborg, Toldam-Andersen, Zhang, et al. 2017; Miele et al., 2017). The modifications included a Napping (Pagès, 2003; Risvik, McEwan, Colwill, Rogers, & Lyon, 1994) with subsequent attribute generation as the word generation step and a limitation on the number of attributes in the product ranking. The previous work was conducted on model wines with moderate sensory differences. To further study the impact of modifications on FP, complex red wines were used in the current work.

The effect of the number of assessors on the outcome of modified FP was another important issue in the design of sensory studies. Some studies have been published studying the optimal panel size for conventional descriptive analysis (Gacula & Rutenbeck, 2006; Heymann, Machado, Torri, & Robinson, 2012); the number of consumers needed for acceptability tests (Mammasse & Schlich, 2014); or influence of the number of consumers on the stability of sensory spaces obtained from Check-All-That-Apply (CATA) questions (Ares, Tárrega, Izquierdo, & Jaeger, 2014), Napping (Vidal et al., 2014), and sorting (Blancher, Clavier, Egoroff, Duineveld, & Parcon, 2012). For the FP method, eight assessors were recruited in the original research study (Dairou & Sieffermann, 2002); Delarue (2014) declaimed that four or five was minimum for conducting FP. However, no research studies have been published for evaluating the effect of the number of assessors on the outcome from the modified FP method.

Therefore, the objectives of the present study were: (a) To compare the rating-based FCP and ranking-based FP methods; DA was used as a reference method. (b) To explore whether adding adjustments to existing rapid method could improve results. (c) To investigate the influence of the number of assessors on the outcome of modified FP. The methods were compared according to their configuration outputs, their descriptive abilities, and their practical differences.

2. Materials and methods

2.1. Samples

Nine red wines made from *Vitis vinifera* cv. Merlot grapes were used for sensory analysis. The wines were from another study that investigated the effects of modifying wine ethanol concentrations on chemical and sensory profiles of Merlot wines (Sherman, Greenwood, Villas-Bôas, Heymann, & Harbertson, 2017). The winemaking techniques of chaptalisation and saignée – water addition were utilised prior to fermentation. Grapes were harvested on three dates with different maturity (unripe, ripe and overripe), corresponding to soluble solids concentrations of 20, 24 and 28 Brix. Each harvest was divided into three: one third was fermented at the natural soluble solids concentration and the other two thirds were manipulated to match the other harvest's soluble solids concentrations leading to average wine ethanol concentrations of 11.6%, 14.0% and 16.2% for each of the three soluble solids levels. Each type of fermentation was conducted in three replicates and in total 27 wine samples were obtained. Sherman et al. (2017) had found that replicates of fermentation had no significant influence on wine properties, and thus in the present study 9 wine samples were randomly selected from three replicates of fermentation for running rapid sensory tests. The list of wine samples is shown in Table 1.

Table 1
Wine samples fermented with different grape maturity and ethanol content (soluble solids adjustment before fermentation). The mean values and standard deviations of the soluble solids content are presented.
(Adapted from the study by Sherman et al., 2017.)

Original soluble solids	Soluble solids adjustments	Codes of samples
Harvest 1: unripe	Control (~20 Brix)	H1_Low
20.7 ± 0.5 Brix	Chaptalise to 24 Brix	H1_Medium
	Chaptalise to 28 Brix	H1_High
Harvest 2: ripe	Saignée - water-back to 20 Brix	H2_Low
24.0 ± 0.2 Brix	Control (~24 Brix)	H2_Medium
	Chaptalise to 28 Brix	H2_High
Harvest 3: overripe	Saignée - water-back to 20 Brix	H3_Low
27.4 ± 0.4 Brix	Saignée - water-back to 24 Brix	H3_Medium
	Control (~28 Brix)	H3_High

2.2. Sensory methodology

2.2.1. Experiment overview

A conventional descriptive analysis (DA) as well as several rapid sensory methodologies were carried out. An overview of all sensory tests is shown in Fig. 1. The DA method was performed in triplicate for aroma, in-mouth flavour, basic taste, mouthfeel described by Lawless and Heymann (2010). Aroma, detected orthonasally (by smell), and in-mouth flavour, detected retronasally (in mouth) were separately assessed in DA. For each of the rapid sensory methods, the aroma and in-mouth flavour were not separately assessed. In all of the sensory tests performed, assessors were instructed to rinse with water and/or a cracker between samples to minimise carry over effects such as adaptation. The samples were served at 20 ± 1 °C in standardised wineglasses (ISO-3591, 1977), which were coded with 3-digit numbers and covered with a watch glass. All the sensory evaluations took place in the sensory laboratory at the University of California (UC) Davis.

2.2.2. Assessors

The semi-trained assessors were recruited based on their availability and commitment to participate, from the students, staff, and retirees of the Departments of Food Science & Technology and Viticulture &

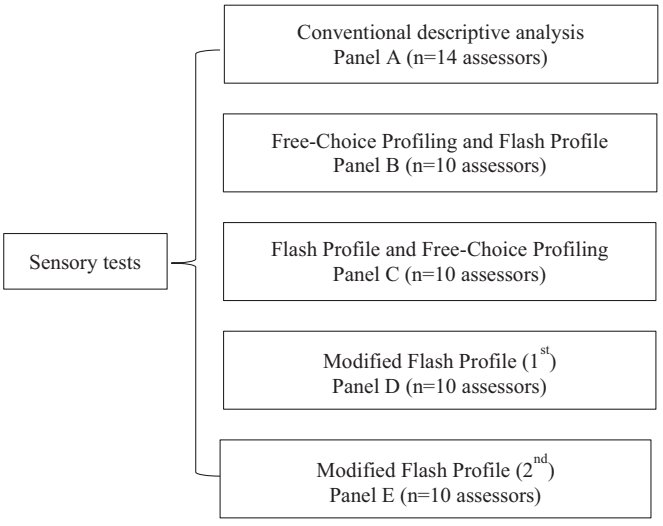

Fig. 1. Overview of sensory tests carried out in this study.