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Commentary

The official method for olive oil sensory evaluation: An expository revision of certain sections of the method and a viable means for confirming the attribute intensities

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ABSTRACT

Background: The official European Union method for a sensory evaluation of virgin olive oils dates back to 1991. The sensory evaluation was included to classify the olive oil into the proper category. The necessity for well-trained tasters to serve on panels has promoted many olive oil-tasting schools in areas with an interest in this food.

Scope and approach: The manner in which the method is used can be questionable. This paper indicates certain method features, such as determination of the group detection threshold (GDT), preparation of the taster selection ("selective trials") with the proof for the related formula and a means to verify perception intensity, and underlines the ease in using the prescriptions.

Key findings and conclusions: The proof for the formula used to calculate the 12 attribute dilutions to select the panel taster candidates is provided, which begins with the Weber's Law. Furthermore, the 12 dilutions are related to preliminary work by the panel leader to determine the group detection threshold (GDT). Finally, to overcome the problem of verifying attribute intensity, a relationship between the intensity of the perception and the given score on the 10 cm line was proposed using a formula that considers the corresponding intensities of the two line ends. Simple dilution steps are then proposed to determine the "real" score.

1. Introduction

Extra virgin olive oil (EVOO) consumption continues to grow everywhere that awareness about its benefits becomes clearer. The main production area is around the Mediterranean, which accounts for more than 95% of olive oil production worldwide (IOC, 2015). For many reasons (e.g., cultivar, climate, soil, weather trend, pest attacks, olive orchard management and the transformation process used to extract oil from the fruits), olive oils have different qualities, which must be ascertained to classify the oil in the right category based on current law. EVOOs are in the high-end category in terms of health benefits and sensory characteristics. As early as the mid-1980s, a reliable method for evaluating an olive oil based on its sensory profile was clearly necessary. In fact, at the 45th IOOC Session held in November 1981, a co-operative programme aimed at constructing an internationally recognized and mandatory olive oil tasting method was proposed, and many countries adhered to the concept and joined the group. The likely first full method devoted to olive oil sensory analysis was constructed and described by a working group at the "Stazione Sperimentale Oli e Grassi" in Milan (Italy) (Camurati, Cozzoli, & Fedeli, 1985), which also provided a "profile sheet" to annotate both perceptions and their intensity in accordance with a 0 to 5 "structured" scale used for scoring. A previous paper that only considered taster selection was already available (Gutiérrez Rosales, Alba Risco, & Gutiérrez Gonzalez-Quijano, 1984), but likely it was not considered by Camurati et al., 1985. The profile sheet listed different sets of both positive and negative (defects) olfactory and gustatory notes. The final overall score was used to classify the oil as an EVOO or lower grade oil in accordance with the classification in force. In 1987, the International Olive Oil Council (IOOC, now the International Olive Council, IOC) issued certain preparatory documents required to correctly perform the olive oil sensory assessment (COI/T.20/DOC.4,5,6/1987). In 1991, the European Economic Community adopted Regulation (EEC) n° 2568/1991 of July 11th, 1991, in force as of September 1st, 1991 (EUR-Lex). This Regulation replaced and

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abolished any "local" law on the subject and became the European reference standard for olive oil trading. Annex XII (applied as of January 1st, 1992) was titled "Organoleptic assessment of virgin olive oil" and was the first official method for that purpose adopted by all EEC Member States. Eventually, in 1996, the IOOC also issued documents to complete the full method that strictly resembled the EEC method (Organoleptic assessment methods, 1996). Since then, certain IOC method sections have improved, and the profile sheet has undergone several changes; the main change is the move from a "structured" scale to a non-graduated scale for scoring in the attribute intensity assessment (Organoleptic assessment methods, 1996). The aim of this paper is to indicate certain method features that should be performed more accurately. Moreover, as an outcome of this review, a means for verifying the precision of the attribute intensity evaluation is provided.

2. The IOC method documents of interest

The official method is essentially based on the papers by Gutiérrez Rosales et al. 1984; Wittes and Turk, 1968; COI/T.28/Doc.n°1/2007.

This paper refers to the IOC method release now in force, for which the reader can find all of the details (Organoleptic assessment methods, present release). It is composed of many documents; each one regulates a specific subject. In particular, this paper considers the following: first, it considers the "*Guide for the selection, training and monitoring of skilled virgin olive oil tasters*" (COI/T.20/DOC.14/2013). Paragraph n.3 considers "*Determination of the detection threshold of the group of candidates for characteristic attributes*". The characteristic attributes are fusty, winey, rancid and bitter, and the group detection thresholds (GDT) should be determined for each. The GDTs are used to prepare the solutions for the "selective trials", as described in paragraph n.4, "*Selection of tasters by the intensity rating method*".

Second, this paper considers the "*Sensory analysis of olive oil – Method for the organoleptic assessment of virgin olive oil*" (COI/T.20/DOC.15/2015).

3. Determining the group detection threshold (GDT)

A group is composed of candidates willing to join a panel; they are selected based on their sensory skill. For this process, the GDT must be determined, which requires that the panel leader find olive oils with the highest possible intensity of a single attribute (let it be referred to as the "starting oil"), one for each of the 4 characteristic attributes. He prepares consecutive dilutions at 50% (1/2 ratio) with a neutral support (refined oil or paraffin) until he is no longer able to recognize the difference between the last 2 dilutions and the support. Next, he sets aside the last 7 preceding dilutions and the neutral support. Each candidate is randomly given all 8 couples of oils composed of the single dilutions with the neutral support (one glass containing the support and one with a "starting oil" dilution or the support) and is asked to smell/taste them and indicate whether the two oils are the same or different. The panel leader records all answers for each candidate. He then prepares a graph with the oil dilution ratio on the x-axis and the percentage of the corresponding correct answers on the y-axis. The GDT is the lowest "starting oil" concentration recognized as different from the neutral support by at least 75% of the candidates.

4. Derivation of the formula $C_{10-n} = C_{10} * 1.5^n$

When the GDTs are known, the candidates face a selection process for joining the panel through "selective trials" that are used to test their sensory skill. In this process, the panel leader must prepare 12 solutions for each characteristic attribute in accordance with the concentration calculated using the formula provided by the method:

$$C_{10-n} = C_{10}*1.5^n,$$

where

C_{10} = GDT for the attribute under consideration
C_{10-n} = concentration of the attribute corresponding to n
n = an integer ranging from 9 to −2; and
1.5 = dilution factor.

The "selective trials" test the candidate's ability to distinguish the attribute intensity by comparing it to other samples in a line of glasses. The candidate must replace the glass taken from a line-up of the 12 glasses in the right position through comparing its odour intensity attribute (or taste for bitterness) with the glasses in the line. This trial is repeated 4 times per attribute, thus, 16 times in total. The method allows candidates a number of mistakes and provides a means of computing the score: the difference between the correct and assigned position must be squared to produce the score each time. Mistakes of no more than 3 positions at a time (9 points) and a maximum final score of 34 are allowed for a successful test.

Because it is not easy to find the formula proof in the scientific literature, it is worth providing in a simplified manner. The psychophysical law that holds is the Weber's Law (1846).

$$\Delta I/I = k,$$

where

I = stimulus intensity
ΔI = just noticeable difference (JND), which is the minimum difference between two stimulus intensities necessary to determine that they differ; and
k = constant that commonly ranges from 0.1 to 0.5 (Norwich, 2003).

The stimulus intensity is strictly related to the odorant/tastant concentration; thus, "I" can be replaced by "C" in Weber's Law: $\Delta C/C = k$. Using k = 0.5, which is the greatest JND in that range, is a convenient choice without more accurate measurements because it considers the greatest JND that renders the intensity difference easily recognizable.

Thus, $\Delta C/C = 0.5$; that is, $\Delta C = 0.5*C$.

Therefore, $C_2 = C_1 + \Delta C = C_1 + 0.5*C_1$; that is, $C_2 = C_1*1.5$.

The method is used to calculate C_3.

$C_3 = C_2 + \Delta C$, and $C_3 = C_2 + 0.5*C_2$; that is, $C_3 = C_2*1.5$. However, $C_2 = C_1*1.5$. Thus, $C_3 = C_1*1.5*1.5$;

that is, $C_3 = C_1*1.5^2$.

Thus, the general formula is $C_{n+1} = C_1*1.5^n$.

For the method, the indexes must range from 1 to 12, and the reference concentration must be the GDT C_{10}; the general formula then becomes the following:

$$C_{10-n} = C_{10}*1.5^n \text{ with } 9 \geq n \geq -2, \text{ q.e.d.} \quad (1)$$

It is worth to noting this formula and the means of preparing the 12 solutions per attribute.

To prepare the solutions, 12 consecutive dilutions must be prepared beginning with the oil with the attribute intensity C_1. Based on (1), the ratio between the contiguous solution concentrations is clearly 1.5, i.e., 3/2. In practice, the 2/3 ratio must be used for the dilutions (i.e., to produce C_2, 2 parts of C_1 must be diluted