Sensory profiling: a method for describing the sensory characteristics of virgin olive oil

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SUMMARY

Sensory profiling: a method for describing the sensory characteristics of virgin oilve oil.

Sensory profiling is an objective, descriptive technique which uses a panel of trained assessors. It was used at Campden to differentiate olive oil which differed in terms of the country of origin, variety, ripeness and extraction techniques. The data were related to similar results from the Netherlands and Italy. The results indicated that all three sensory panels perceived the samples in the same way, however, the differed in the way the oils were described.

The new European legislation on olive oil is partially concerned with the sensory aspects of the oil. The sensory grading takes into account the 'positive' and 'negative' attributes in the oil before giving an overall quality grade. These attributes do not reflect the consumer requirements, therefore, the grading should be restricted to the assessment of the presence or absence of sensory defects.

KEY-WORDS: Legislation - Sensory profiling - Virgin olive oil.

1. INTRODUCTION

Sensory analysis is a scientific discipline which has been used to analyse and interpret reactions to those characteristics of olive oil as they are perceived by the senses of sight, smell, sound, taste and touch. Sensory analysis can take two forms depending on the type of information required, an objective approach and a subjective approach (Lyon et al., 1992; Watson, 1992). The subjective approach measures whether a product has satisfied consumer needs. The objective approach is more analytical, and is designed to investigate whether product differences can be established and described.

This paper will discuss the application of one sensory method, sensory profiling, and how it was used to describe the sensory characteristics of virgin olive oil. The paper will be divided into two main parts, the first dealing with the methodological approach to sensory profiling, the second discussing the practical uses of sensory profiling. Comments will also be made on the sensory methods incorporated into the European Unions' Regulation No. 2568/91 on 'The characteristics of olive oil and olive residue oil, and the relevant methods of analysis.'

2. SENSORY PROFILING

Sensory profiling is a descriptive technique which has many uses in the analysis of food and drinks. Profiling can be used in the areas of shelf-life studies, product development and quality control. The sensory changes in a product during storage, and the length of time a product can be stored before the quality changes, can both be established by sensory profiling. Within new product development, profiling has a number of uses; it can be used to quantify the sensory differences between products, whether the differences are due to process or ingredient changes. When linked to consumer data it can also be used to identify the sensory attributes which are associated with the most liked or least liked sample. Sensory profiling can also provide the information required for a product to match the sensory characteristics of a brand leader.

Sensory profiling in one form or another, has been used in the sensory analysis of food since the early 1950's. Sensory profiling can take many different forms; consensus profiling, Quantitative Descriptive Analysis (QDA), free choice profiling and some grading techniques (Lyon et al., 1992). Sensory profiling is a highly analytical technique which can be used to investigate a wide number of objectives and problems. The definition of a sensory profile has been incorporated in the International Standards Organization (ISO) document 'General Guidance for Establishing a Sensory Profile' (ISO/TC34/SC12N 289E); which states that a sensory profile is 'a description of the sensory properties of a sample, consisting of the sensory attributes in order of perception, and with the assignment of an intensity value for each attribute.' This paper will concentrate on QDA as it is the most widely used descriptive method within the field of sensory analysis.

The preliminary stages of sensory profiling involves the collection of sensory descriptors from trained assessors. Having done this, the panel leader presents the terms to the sensory panel for further refinement, accurate definition and determination scale anchor points. The presentation of the widest possible range of samples allows the panel to generate the widest possible range of descriptive terms, which adequately describe the samples presented. The

scale used during the assessment can be either an unstructured line scale, or a more structured category scale (Land and Shepherd, 1988). The ISO document concerned with sensory profiling has also outlined the steps required in the establishment of a sensory profile, these are shown below:

1. Establish a sensory facility.
2. Select products that illustrate the range of attributes to be encountered.
3. Select and train assessors.
4. Determine the perceived attributes.
5. Establish the order of perception.
6. Select the scale of intensity.
7. Conduct the test, and report the results.

Before establishing a sensory facility, the potential workload of the sensory panel must have been balanced against the initial capital outlay of providing dedicated facilities. Sensory analysis can be undertaken in all types of facilities, from a simple round table discussion to fully equipped computerised sensory booths. Sensory facilities are varied, but the general principles are the same. It is important to minimise bias which could be introduced from the test environment, and this is most commonly done using coloured lighting, neutral grey decoration and furniture, and sensory booths. The facilities used in sensory analysis are discussed in greater detail elsewhere (Meilgaard et al., 1987; ISO, 1988).

One of the most important aspects of sensory profiling, is the use of selected and trained assessors. There are many different tests which can be used during the selection of potential assessors, examples include basic tastes, colour blindness and matching tests (ISO, 1993). With sensory profiling, by far the most important test is to evaluate the assessors' descriptive ability, which includes for example whether an assessor can describe what they perceive in words which can easily be understood by other assessors. Once selected the assessors need to be trained in the aspects of sensory profiling and the assessment of samples.

3. AN EXAMPLE OF SENSORY PROFILING: OLIVE OIL

As part of the EC FLAIR programme, a project was undertaken on 'Sensory and Nutritional Quality of Virgin Olive Oil in Relation to Variety, Ripeness and Extraction Technology' involving a number of European participants. The olive oil samples assessed by sensory profiling are shown in Table I. These samples were made from olives of different ripeness and varieties, obtained from different countries and extracted using different techniques. The Campden panel of trained sensory assessors used these samples and agreed the terms and definitions shown in Table II (McEwan and Watson, 1993; Watson and McEwan, 1994). Samples were assessed and the results presented in a format to highlight the sensory profile of each sample, and the differences between samples (Figure 1).

Table I
The samples used during the FLAIR project on the sensory characteristics of virgin olive oil.

	Name	Ripeness	Country	Treatment
A	Coroneiki	Unripe	Greece	Centrifugation
B	Coroneiki	Normal	Greece	Centrifugation
C	Coroneiki	Over-ripe	Greece	Centrifugation
D	Coroneiki	Normal	Greece	Percolation
E	Tzunnati	Normal	Greece	Centrifugation
F	Coratina	Unripe	Italy	Centrifugation
G	Coratina	Normal	Italy	Centrifugation
H	Coratina	Over-ripe	Italy	Centrifugation
I	Coratina	Normal	Italy	Expression
J	C. di Bit	Normal	Italy	Centrifugation
K	Picual	Unripe	Spain	Centrifugation
L	Picual	Normal	Spain	Centrifugation
M	Picual	Over-ripe	Spain	Centrifugation
N	Arbequina	Unripe	Spain	Centrifugation
O	Arbequina	Normal	Spain	Centrifugation
P	Arbequina	Over-ripe	Spain	Centrifugation

Table II
The descriptive vocabulary, and definitions, used by the sensory panel at Campden in describing the samples in the FLAIR project.

Sensory Descriptor	Definition
Appearance Depth of Colour Brightness Amount of Yellow Amount of Green Amount of Brown Clarity	 Depth of overall colour Degree of brightness, not dull Amount of yellow colour present Amount of green colour present Amount of brown colour present Clear, not cloudy
Odour Strength of Olive Grassy Almond Banana Skins Sweet Pungent/Fumy Perfumed Tomato Hay/Compost	 Intensity of olive odour Odour of freshly mown grass Reminiscent of marzipan Reminiscent of under-ripe banana skins Odour associated with sucrose Penetrating vapour-like odour Blossomy/floral Reminiscent of tomato plants/greenhouse Reminiscent of dry/stroed grass
Flavour Strength of Olive Grassy Almond Banana Skins Hay/Compost Perfumed Under-ripe Tomato Harsh	 Intensity of olive odour Odour of freshly mown grass Reminiscent of marzipan Reminiscent of under-ripe banana skins Reminiscent of dry/stroed grass Scented/floral flavour Reminiscent of green olives, having a sharp/green note, slightly bitter & less fruity Reminiscent of the flavour of tomatoes Unbalanced flavour
Mouthfeel Throatcatching Thickness	 Leaving a burning sensation in the back of the throat after swallowing Having body, not thin and watery

As sensory profiling is an objective, analytical, sensory technique, it is expected that the results are reproducible from session to session and panel to panel. As different laboratories in different countries were involved in this project, it was important to ask the following questions:

1. Do different sensory panels describe attributes in olive oil in the same way?
2. Does language/culture/experience affect the way in which samples are described ?
3. Is it feasible to have an internationally agreed vocabulary for the sensory profiling of olive oil, and would the assessors have used this language in the same way ?

In answering these questions, sensory profiles from the United Kingdom, Netherlands and Italy were compared.

The number of attributes varied considerably with 26 British attributes, 68 Dutch attributes and 18 Italian Attributes. Superficially, some of the terms were fairly similar, although quite a number of the terms were panel specific. Multivariate analysis, generalised Procrustes analysis (McEwan and Hallet, 1990), was used on the three data sets to investigate the questions further. The sample plot (Figure 2) shows each of the samples (A to P) as positions on the graph; the triangles, for each sample, represent the data from the three, U.K., Italy and the Netherlands. The smaller the triangles, the more similar the perception of the samples between countries. Figure 2 also shows that the samples from each country are in a similar area of the plot. Therefore, the olive oil samples were perceived in a similar way, irrespective of the panel or country which analysed the olive oil.
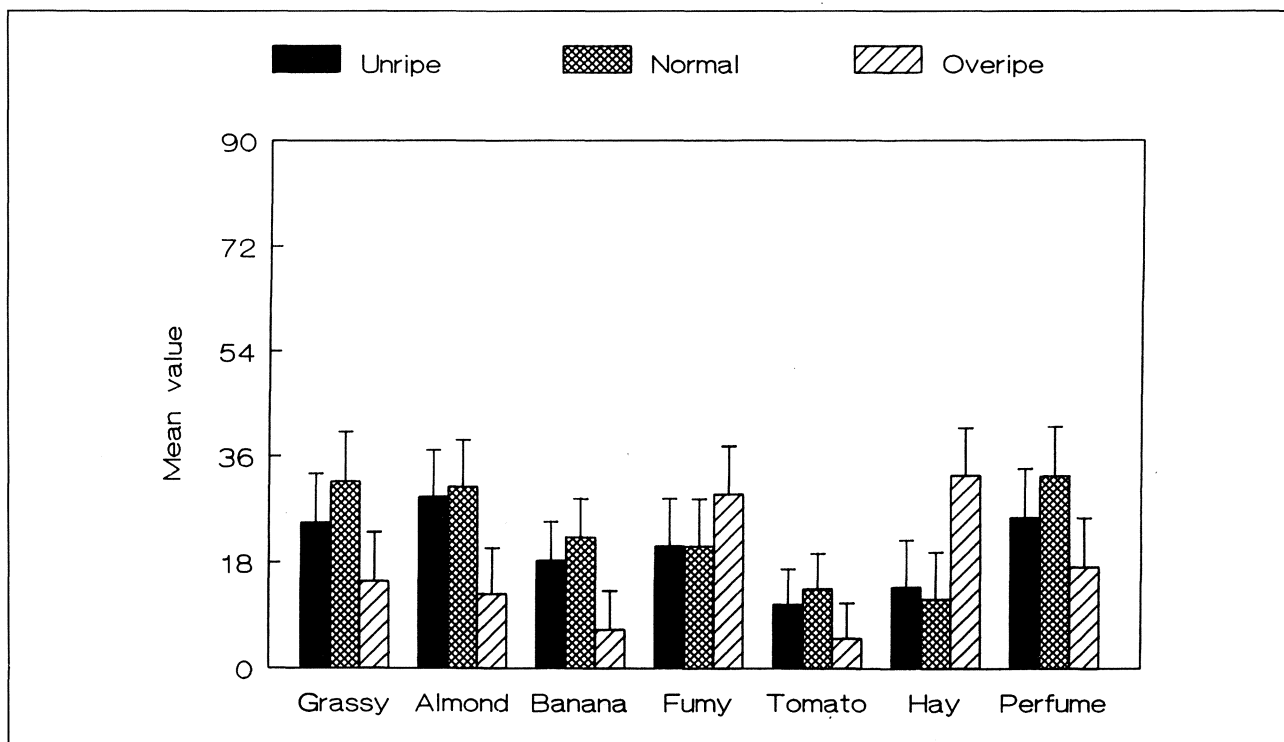
Figure 1
An example of a histogram, with the error bars, which was used to distinguish the odour of the Coratina
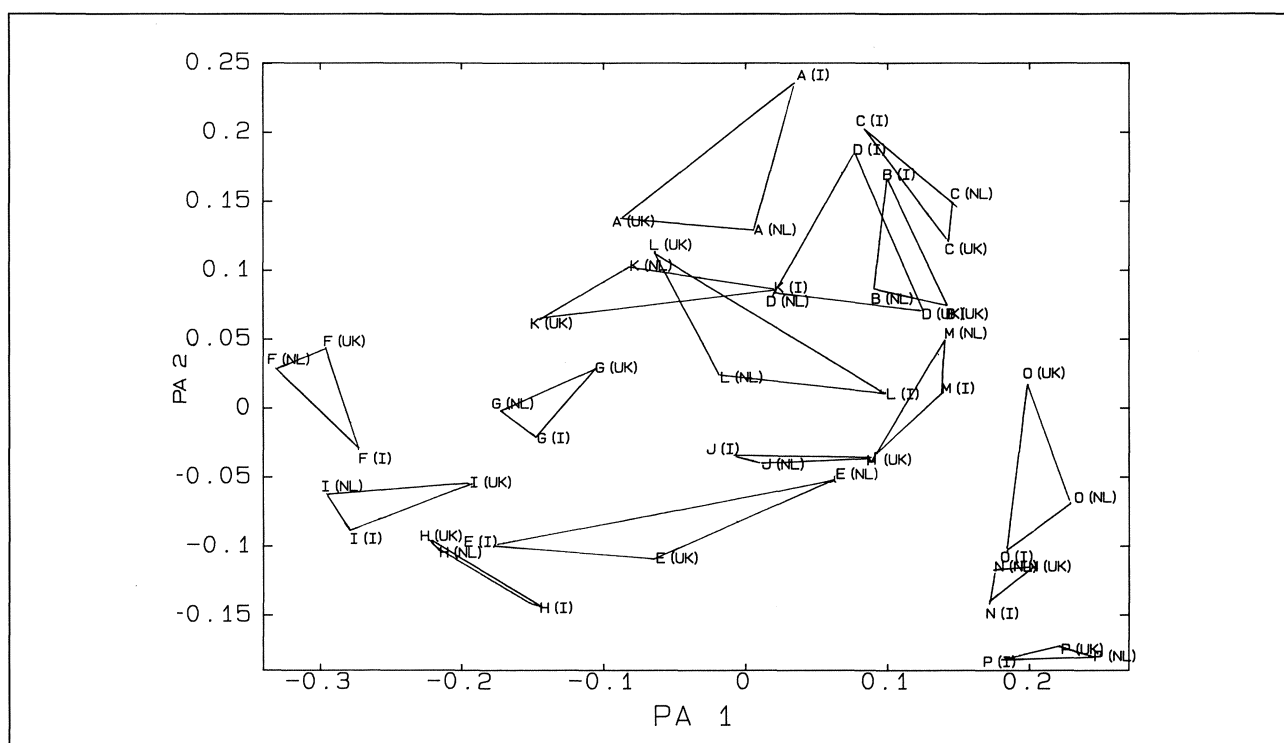samples made with olive at different degrees of ripeness.

Figure 2
The sample plot obtained by generalised Procrustes analysis for the data from the three countries involved,
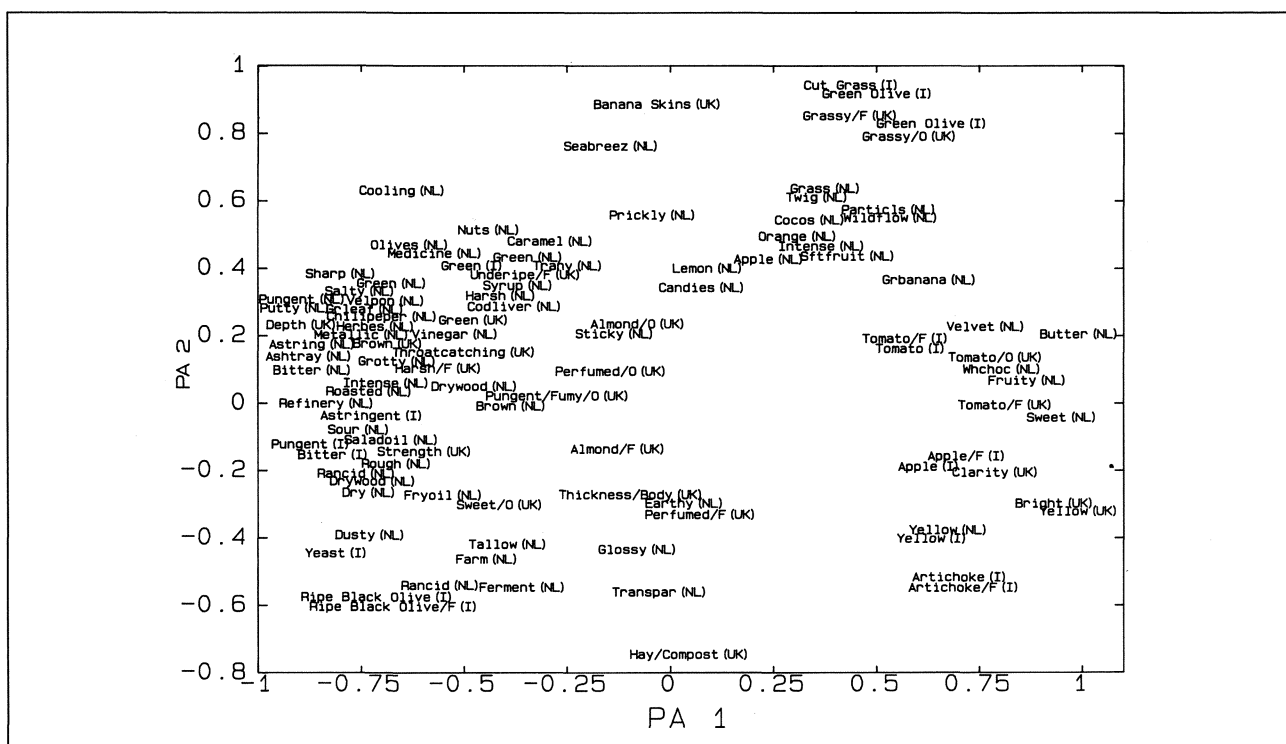United Kingdom (UK), Italy (I) and the Netherlands (NL).

Figure 3

The attribute plot obtained by generalised Procrustes analysis for the data from the three countries involved, United Kingdom (UK), Italy (I) and the Netherlands (NL).

The way a panel described the oil was also investigated using generalised Procrustes analysis (Figure 3). The position of the attributes represent directions of increasing intensity from the origin, and those attributes which are perceived in a similar way by the panel will be found in a similar area of the plot. For example, the terms cut grass, grassy, banana skins and green olive are all found towards the top of Dimension 2, hence the terms are being used to describe a similar perception by the panel. So, although the three panels perceived the oils in a similar way, the descriptions applied to each oil differed (Watson and McEwan, 1994). These differences in terminology are probably due to differences in the language, culture and food experience. Using other forms of statistical analysis, such as cluster analysis, a flavour wheel was developed which contained these data as a basis for an agreed vocabulary for the sensory profiling of olive oil (FLAIR Project No. 89041).

4. THE SENSORY ASPECTS OF THE EUROPEAN UNION REGULATIONS ON OLIVE OIL

In the context of international trade in olive oil, it is only questions related to conformance which can and should be regulated. Questions related to the character and acceptability of olive oils are specific to an individual customer and should not be regulated. Any Regulations which specify sensory methods must therefore restrict grading of oils to the presence and absence of sensory defects, the presence of which would preclude those oils from being sold as virgin olive oil. These sensory defects include 'defects which appear because the oil has been extracted from fruit that has been stored for too long and as a result has gone rotten, or because of serious defects in the extraction or storage of the oil' (International Olive Oil Council, 1987).

The European Union Regulation No. 2568/91 "Characteristics of Olive Oil and Olive Oil Residue Oil and the Relevant Methods of Analysis" is partially concerned with the sensory aspects of olive oil. The sensory aspects deal with 'the grading of olive oil on a numerical scale related to the perception of its flavour stimuli according to the judgement of a group of selected tasters working as a panel'. There are two aspects to the rating system, the first is a form of sensory profile in which the assessors rate the intensity of a range of attributes on a 6 point scale. The second part allows the assessors to rate 'overall quality' on a 9 point scale taking into account the 'positive' and 'negative' attributes. This overall grading is then used as a measure of the quality of the oil. Virgin olive oil is required to have received a panel score of equal to, or more than, 5.5 on the scale, with the implication that the higher the score, the better the quality. The fundamental difficulty with this approach is that the 'positive' notes refer to those characteristics which may, or

may not, be desirable from the marketing point of view. The terms have not been selected on the basis of consumer requirements, and as a result this grading system may reject samples which the consumer finds acceptable, and visa versa. Sensory profiling should be used therefore, to understand the character of the olive oil, so the appropriate oil can be matched to the market requirements, and the grading system to determine quality, should be restricted to the assessment of presence or absence of sensory defects.

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