

SENSORY EVALUATION TECHNIQUES OF FOOD

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Abstract

The article is a pleading for the introduction of sensory evaluation in several areas of the food industry and its use as a valuable tool for evaluating the degree of acceptability of a food, by the consumers. A series of standard guidelines of good practice used in sensory evaluation are presented, which refer both to the layout of the laboratory, as well as to the samples and to the evaluation specialists, as well as the tools used by them to describe and evaluate the sensory aspects of a food product.

Keywords: sensory evaluation, standard guidelines for sensory evaluation, cheese, wine, coffee, salami

1. INTRODUCTION. SENSORY EVALUATION IN A VIEW

The definition of sensory evaluation is the following - a scientific discipline used to describe, measure, analyse and interpret the responses received from a food product and perceived through the senses: sight, smell, touch, taste and hearing.

Sensory analysis can be considered to be an interdisciplinary science that uses the sensory perception of human experts related to attribute determination thresholds, variation in experimental design of individual sensory response to measure the sensory characteristics and acceptability of a food products, and many other materials. (Dimple Singh-Ackbarali & Rohanie Maharaj, 2014)

Sensory evaluation can be used both in food producing companies and in the academic environment and the sensorialist which is the specialist in sensory evaluation and can play several roles depending on the environment in which is carry out the activity.

In a food manufacturing company, a sensorialist works closely with the product developer to understand what consumers like and why, or to discover whether consumers can notice a change in an existing food product by substituting an ingredient.

In the academic area, the sensorialist tries to understand how our senses work and how they respond to external stimuli (both from food and chemicals). Also, the sensorialist can work in his day-to-day work to improve the food testing methodology.

The main reason why the sensory evaluation is used in addition to the physico-chemical, microbiological and nutritional evaluation of a food is to perform a complete analysis and description of it in order to establish the degree of acceptability among consumers. Even if a food product has food safety ensured by compliance with all microbiological criteria, it has a nutrient content that satisfies all the body's needs, if it is not tasty it will be rejected by consumers.

Understanding "what" consumers want and "why" are two of the most significant hurdles faced by any business creating products for consumers. Properly conducted sensory research experiments can provide answers to these questions and more. (Stone, H and Sidel, JL, 2012)

Thus, the role of the sensory evaluation of a food product can be explained in several directions:

- It helps to reduce the unknowns and risks in making a decision to launch a food product on the market
- It ensures an efficiency of the costs of making a new product, with high acceptability to the final consumer
- It helps to establish order in national and international competitions
- And last but not least, it was found that human observers are very good measuring instruments because they can sometimes detect odours at a much lower level than can be detected with the help of instruments. Also, the instruments cannot measure the liking or the degree of pleasure (satisfaction) for a food product. In order to improve the sensory testing methodology, you must use sensory experts who can tell from the conclusions of a test, if the method is effective or not, in other words, if the results obtained help to solve a problem or require certain fine adjustments.

2. INTERNATIONAL STANDARDIZATION OF SENSORY EVALUATION

Sensory evaluation methods have been standardized with the help of general standards and various more specific standards, such as: guidelines for methodology and special ones dedicated to the sensory evaluation of foods. These standards have been put in place by several existing standardization organizations in the world, among which we mention: the British Standards Institute (BSI), the International Organization for Standardization (ISO) and the American Society for Testing Materials (ASTM).

2.1. General standards

Among the general standards, the first one that appeared was numbered **ISO 3591:1977** and now it has turned into **ISO TC 34 SC 12**, where **TC 34** refers to "Food products", and the extension **TC 34 SC 12** refers to "Sensory analysis". The number of general standards published so far that refer to sensory evaluation is 29 and of revisions and new amendments is 10.

2.2. Guiding standards

Below is the codification and reference of the guidance standards in which various aspects of sensory evaluation are presented in more detail, namely: the methodology for performing a sensory evaluation, how to establish the sensory profile of a food, how to select tasters, how to arrange of a tasting room and what the laboratory staff working in a sensory testing laboratory must know:

- **FDIS 6658** (under revision) General instructions - methodology
- **ISO 13299:2016** General instructions for establishing the sensory profile
- **ISO 13299:2012** General instructions for the selection of untrained or expert tasters
- **ISO 8589:2010** General instructions for the arrangement of a tasting room
- **ISO 13300-1:2006** General instructions for the staff of a sensory testing laboratory – staff responsibilities
- **ISO 13300-2:2006** Part 1 Recruitment and training of a taster leader(www.iso.org)

2.3. Standards for methodology

In order to describe in more detail, the methodology for initiating and training tasters and testing their sensory acuity, the standards for methodology were created, among which we mention:

- **ISO 3972:2011** Methodology – Method for investigating taste sensitivity
- **ISO 5496:2006** Methodology – Initiation and training of tasters in the detection and recognition of odors (www.iso.org)

2.4. Food sensory evaluation standards

Although most of the presented standards refer to the sensory evaluation of food, lately there are concerns about the influence of the packaging on the food product, but also ways of establishing and verifying the durability of a food product are being sought, that is why these 2 were created standards:

- **ISO 16779:2015** – Sensory analysis – Evaluation (determination and verification) of the durability of a food product
- **ISO 13302:2003** - Sensory analysis - Methods for evaluating flavor changes due to packaging (www.iso.org)

3. GOOD PRACTICE GUIDELINES IN SENSORY EVALUATION

3.1. Conditions for test rooms

The test rooms must be designed so as to meet the following conditions:

- ✓ The walls should be painted white or almost white color
- ✓ Lighting must be controlled
- ✓ The ventilation must be perfect
- ✓ It would be ideal to have individual test booths
- ✓ The room should not be noisy

- ✓ Reasonable space must be provided for each taster

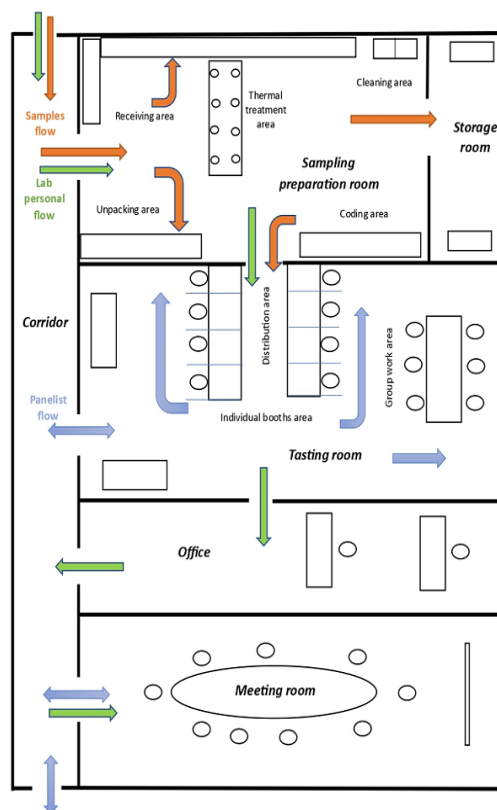


Figure 1. Sensory evaluation laboratory flows

3.2. Test samples

The test samples must be properly prepared, as follows:

- The temperature must be controlled and must be the same for each sample. For example, in cheese tasting if one piece of cheese is colder than other it would not have the same aroma with the cheese which stayed in the room temperature for 15 minutes.
- The quantity served should be the same for all samples, because if one piece is bigger than others the tendency is to mark much more than others.
- The samples must be served within the validity period and prepared (if necessary) in the same way, because the preparation method could influence the taste and the smell of a product.

3.3. Sensory evaluation design

Samples must be numbered with a random 3-digit code to avoid bias.

Samples must be served randomly or in counterbalanced order. Counterbalanced order means that if 2 samples are served, half of the tasters receive the first sample, and the other half receive the 2nd sample.

For the design of the sensory evaluation, the following aspects must also be taken into account:

- ❖ The best time of the day for tasting is in the morning from 10.00-12.00 and in the afternoon from 15.00 to 17.00

- ❖ Evidence must be judged quickly, but not in haste
- ❖ Optimal tasting takes place in individual panels to avoid discussions between tasters.

4. SENSORY EVALUATION METHODS

For the sensory evaluation, a series of tests have been developed, the most complete of which are the descriptive ones. (Lawless, HT and Heymann, H., 1998). They can be of several types as follows.

4.1. Descriptive tests

- Descriptive test with tie-breaker
- Descriptive evaluation test – a product
- Descriptive evaluation test – two products

For the descriptive tests, only trained tasters are used who can accurately describe the analysed parameters of a food product.

Table 1. Descriptive evaluation test description

Questions	Method	Organization
If the products are different, how different are they really?	Descriptive analysis tests	6-10 trained tasters Scan for acuity of perception Ask them to rate the intensity for all the attributes of the sensory analysis Statistical analysis tests: T-test or ANOVA test to determine if the perceptions are statistically different.

4.2. Difference tests

- Simple difference test for paired preferences
- Associated comparative directional tests
- The triangle tests
- The duo-trio test

The difference tests can also be used by untrained tasters who can easily detect the difference between 2 or more food products.

Table 2. Diferenta evaluation test description

Questions	Method	Organization
Are the products different?	Difference test	20-50 tasters Scan for taste and smell acuity (intensity or clarity of perception) The analysis is carried out using statistical tables that compare the results with chance - these analyses ensure that the differences are real, not because people chose the correct sample by chance/luck. Statistical analysis tests: - One-tailed binomial test, 2-tailed binomial test and Chi-square test

4.3. Tests of preference

- Pair preference test

- Hedonic evaluation tests
- Food performance evaluation test
- Preference test with tiebreaker

Preference tests are the most used tests by the marketing department of a company, because they are the tests whose results show whether the food product will be accepted or not by consumers. Untrained tasters usually participate in these tests, and their number must be large enough for the results to be conclusive.

Table 2. Preferinta evaluation test description

Questions	Method	Organization
What is the degree of acceptability of the product? Is one product more preferred among consumers than another?	Preference tests: affective/hedonic	75-150 consumers per test Minimum 20 for pilot tests Scan for product usage (Buy the product? How many times?) Ask about the degree of sympathy for the product (how much they like it) and/or preference questions Statistical analysis tests: Friedman test, T-test, 2-tailed binomial test, ANOVA test

4.4. Sensory analysis word data base

In the descriptive tests, specific words are used that represent descriptors of the sensory characteristics evaluated in a food product. Thus, for each sensory characteristic, several words were found that can describe it as best as possible, these words being grouped in the so-called word data base used in sensory analysis.

Table 4. Words describing the sensory characteristics of a food product (Lawless, HT and Heymann, H., 1998)

Appearance	Taste	Smell	Texture	Sound
Attractive	Acidic	Flavoured	Sticky	Crispy
Brilliant	Bitter	Astringent	Aerated	Fizzle
Clear	Burned	Burnt	Gumming	Graceful
Cold	Creamy	Coffee like	Cold	Acidulated
Colourful	Buttery	Fermented	Crystal	Sparkling
Creamy	Herbaceous	Floral	Dry	
Dark	Spicy	Fresh	Elastic	
Dry	Salty	fruits	Fibrous	
Fresh	Smoked	Rancid	Foamy	
Wet	Spice	Baking	Soft	
Opaque	Off flavour	Smoked	Aqueous	
Pale	Aqueous	Spicy	Rubber	
Powdery	Unripped	Mouldy		
Fatty				
Sticky				
Aqueous				

5. TOOLS USED IN SENSORY EVALUATION

In the sensory evaluation carried out through descriptive tests, specific *evaluation sheets* were created for each food product that follow exactly all the sensory characteristics of a food and which must be completed by each individual taster. After establishing the sensory profile, the so-called *evaluation wheels* were created with the help of which the trained tasters (sensorialists) can complete the descriptive tests. Below will be presented the tasting sheets used for the tasting of matured cheeses,

created by ONAF (Organizzazione Nazionale degli Assaggiatori di Formaggio), also the tasting sheet of raw dried salami created by ONAS (Organizzazione Nazionale Assaggiatori Salumi), that of the wines used in international contests and accepted by OIV (International Organization of Vine and Wine), as well as the test sheet of Italian espresso created by IIAC (Institute International Assaggiatori Caffè). With the exception of ONIV, which is an international body, all other bodies are located in Italy. In our country, the FNDA (National Federation of Authorized Tasters) was created, which with the support of the Italian organizations that held courses, is trying to create the nucleus of authorized tasters in Romania.

5.1. Ripened cheeses evaluation sheet and wheel

SCHEDA VALUTAZIONE FORMAGGI FNDA

TIPOLOGIA _____ data _____ campione N° _____
Luogo _____ COMMISSIONE _____
DEGUSTATORE _____

VALUTAZIONE COMPONENTE VISIVA										
	punteggio									
	1	2	3	4	5	6	7	8	9	10
ASPETTO ESTERNO										
ASPETTO DELLA PASTA										
OCCHIATURA - ERBORINATURA										
SOTTOCROSTA - STAGIONATURA - CONSISTENZA										
VALUTAZIONE COMPONENTE GUSTO-OLFATTIVA										
ODORE										
STRUTTURA IN BOCCA										
EQUILIBRIO DEI SAPORI										
PERSISTENZA AROMATICA										
TIPICITA'										
COMPLESSITA'										
TOTALE										

NOTE _____

Figure 2. Cheese evaluation sheet
(www.onaf.it)

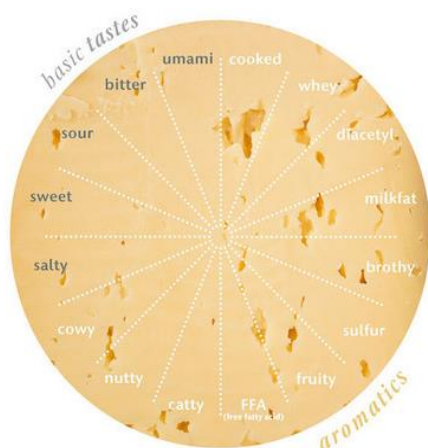


Figure 3. Cheese evaluation wheel
(<https://magazine.wsu.edu>)

5.2. Salami evaluation sheet and wheel

AIR-DRIED AND FERMENTED GROUND MEAT SALAMI FORM

ONAS
ORGANIZZAZIONE NAZIONALE ASSAGGIATORI SALUMI

PRODUCT _____ Sample nr. _____ Seasoning (in days) _____
Taster _____ date / / time _____

	1	2	3	4	5	6	7	8	9	10	NOTE
EXTERNAL EXAM											
EXAM OF THE SLICE											
OLFACTORY EVALUATION	Smells										
	Intensity										
TASTE-OLFACTORY EVALUATION	Taste										
	Aroma										
	Persistence										
TEXTURE	Consistency										
	Chewiness										
TASTE-OLFACTORY BALANCE											
TOTAL SCORE IN 1200											

ONAF - AIR-DRIED AND FERMENTED GROUND MEAT SALAMI Official Form - 2020/06.2 - Reproduction prohibited

Figure 4. Air dried salami evaluation sheet
(www.onasitalia.org)

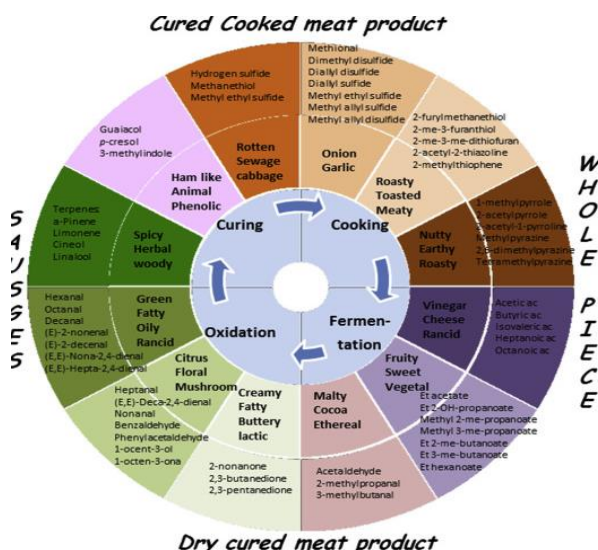


Figure 5. Dry cured meat product evaluation wheel
(Monica Flores, 2018)

5.3. Wine rating sheet and wheel

STILL WINES		Excellent	Very good	Good	Satisfactory	Insufficient	Additional observations
VISUAL	Limpidity	5	4	3	2	1	
	Color	10	8	6	4	2	
NOSE	Intensity	8	7	6	4	2	
	Cleanliness	6	5	4	3	2	
TASTE	Quality	16	14	12	10	8	
	Intensity	8	7	6	4	2	
	Cleanliness	6	5	4	3	2	
	Quality	22	19	16	13	10	
	Persistence	8	7	6	5	4	
	OVERALL JUDGEMENT	11	10	9	8	7	
TOTAL							

Figure 6. Wine evaluation sheet (www.oiv.int)

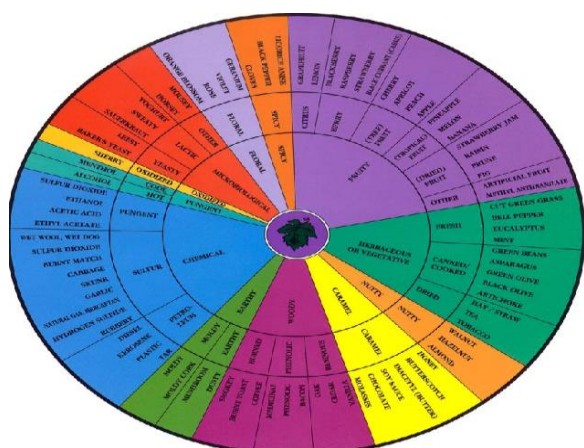


Figure 7. Wine evaluation wheel
(www.thewinecellarinsider.com)

5.4. Coffee evaluation sheet

Figure 8. Coffee evaluation sheet (www.inei.coffee/it)

6. CAREERS IN SENSORY EVALUATION

The tasting specialist can occupy a career position of:

- Scientific sensorialist
- Sensory analyst
- Sensory technician

As companies where a taster can be employed, we mention:

- ✓ Food manufacturers
- ✓ Manufacturers of cosmetics and perfumes
- ✓ Food ingredients producers
- ✓ Academic environment (Universities)
- ✓ Marketing and market research companies
- ✓ Sensory analysis laboratories
- ✓ Consultants/own employees

As job responsibilities, these will be the following:

- Experimental product design
- Sample preparation
- Conducting, analyzing and reporting experimental results
- Consulting/remedial proposals

7. CONCLUSIONS

Humas is the best sensory instrument and by training his senses he can become a good taster who can occupy positions both in the scientific environment (academic) and in the private system. The success of sensory evaluation lies not only in the application of individual tests and techniques, but also in combining sensory principles with the principles of other disciplines so that manufacturers remain attentive to the demands and expectations of customers. Ultimately, their success in food product development and sensory evaluation is determined by their speed to market and the success they bring to market. Sensory analysis is an important tool in food science and must be accepted as a necessary part of food quality experiments. Advances in computer technology as a means of data reception and analysis facilitate more sophisticated statistical methods that can be used by sensory analysts (Dimple Singh-Ackbarali & Rohanie Maharaj, 2014).

There are several tools used in sensory evaluation that the National Federation of Authorized Tasters from Romania (FNDA) has translated into Romanian and they can be used as methods for evaluating the degree of acceptability of food products manufactured by Romanian producers, by consumers.

This is because sensory evaluation is an effective tool that shows whether a food product is or will be accepted by consumers, because it is known that no matter how nutritious it is, if it is not tasty, sooner or later it will be rejected by them.

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