

Sensory Evaluation of Fish Products

Mohan, C.O., Elavarasan, K and Sreelakshmi K.R

Introduction

The safety and wholesomeness of food products are the primary concern of the consumers. Many methods are available to quantify them viz. physical, chemical, microbiological and sensory methods. The first three methods require sophisticated equipment, laborious and time consuming experimental procedures and trained and skilled persons to carryout experiments. The results obtained need not actually depict the real condition of the food product and it will not have sometimes any connection with the actual perception of the consumer. The actual consumer appeal can be reflected in sensory analysis. Sensory evaluation is defined as the scientific discipline used to evoke, measure, analyze and interpret reactions characteristics of food as perceived through the senses of sight, smell, taste, touch and hearing. It measures the physical properties of food by psychological techniques. Sensory methods are used for measuring the properties that cannot be evaluated directly by physical or chemical tests. Conducting sensory tests may not seem difficult to the layman but it is not as easy as it seems. If proper attention is not given in sensory testing the data obtained will not reveal the true situation. It is necessary to be familiar with these techniques, to know when and how to use them and to have a panel that has been carefully screened and trained.

The characteristics of food materials are evaluated depending on the stimulus received when one is testing the material, which are measured and quantified. A stimulus is defined as any chemical or physical activator, which causes a response in a receptor. For example, eye is the receptor for light stimuli; nose for odour, tongue for taste etc. Six classes of stimuli exist. They are mechanical, thermal, photic, acoustic, chemical and electrical. An effective stimulus produces a sensation, the dimensions of which are quality, intensity, extension, duration, like and dislike. The least energy capable of producing a sensation is called absolute threshold. The least stimulus changes perceptible is termed difference threshold. For the study of food materials the senses of sight, hearing, smell, and taste and the four cutaneous (skin) senses viz. cold, warmth, pressure and pain are used. The senses of sight and hearing play a major role in regulating the functions of human world. These senses help him in communication, navigation and detection of objects at a distance. Anyhow, man derives comfort from touch and pleasures of odour and taste. It is generally accepted that the stimulation of one sense organ influences to some degree the sensitivity of organs of another sense. Whether the influence is exerted upon the receptors or upon their central areas in the cortex is not known with certainty.

Laboratory taste panels are used to determine detectable difference and to measure the

amount of certain properties, which cannot be measured readily by physical equipments. Consumer surveys are used to determine preference or acceptance to a particular product by the consumers. Neither of these methods can be used to do the task of the other. When a new product is tested by a laboratory taste panel the assumption that need be made is that the laboratory panel is judging the same basic variables with at least the same sensitivity as the ultimate consumer. Field-testing with untrained judges usually produces large variations in results and thus poor reliability.

Appearance

The quality factors associated with appearance influence food appreciation and preference by the consumer. Colour and appearance are important in the selection and acceptance of fresh fish and processed fish products. Changes in the appearance of the skin and the colour of the gills are closely associated with deterioration in quality. The appearance of the skin of fresh fish is bright and shining with no bleaching which changes to waxy with slight bleaching and the fish which is not acceptable for human consumption has a dull, gritty appearance with marked bleaching and shrinkage. Various colour changes can be noticed in the gills during progressive spoilage which ranges from bright red, to pink during early stages and then to gray, bleached, and finally to brown or dark when the fish is unfit for human consumption. The appearance of outer slime and eyes also can indicate the extent of spoilage in fish. In general we recognize, discriminate and select fish as in the case of food with eye.

Flavour

Flavour is the sensation realized when the food is placed in the oral cavity. It is dependent upon the reactions of the taste and olfactory receptors to the chemical stimulus.

Taste

The word taste means the sensory response to soluble materials in the mouth. This includes aesthetic appearance also. The gustatory cells located in the taste bud are the actual receptors of the sensation. Taste buds have limited lifetime and being renewed about every 210 hour. The response pattern appears to be stable. The anterior portion of the tongue is more sensitive to sweet stimuli, the posterior to bitter substances and the lateral portion to salty and sour stimuli. However there is considerable overlap. Taste is a chemical sense, which is functioned as a warning and as a feeding mechanism. Soluble substances only can produce taste. Salivary glands are important in tasting particularly in dissolving tasteful substances and carrying them to the receptors. The high potassium content in saliva sensitizes taste receptors.

The four basic tastes are sweet, sour, bitter and saline. The numbers of distinct tastes are very large. It is believed that they are combinations of four basic tastes. The four fundamental taste qualities give variable sensations of pleasantness and unpleasantness depending on concentration. There are many factors such as disease, hunger, age, sex, smoking that affect the sensitivity of an individual to taste.

Odour

Odour is defined as that which can be smelled. Odour is the property of a substance that is perceived by inhalation in the nasal or oral cavity. Odour stimuli affect only a small area of the receptor cells located in the ceiling of the inner nose. Odourless would be the verdict when such a sensory stimulus is not received. One problem is that odour cannot be measured quantitatively by nose. Subjective terminology such as camphor like, flowery, fruity etc. are commonly used to describe olfactory

sensations. Sensitivity to odour and degree of liking for odour differs markedly with age.

Texture

Texture deals with the sense of feel. Any sensation that may affect the skin or muscle endings may be considered within the framework of texture. Practically the subject may be limited to hand specifically finger feel and mouth feel. It is suggested that such attributes of mouth feel as chewiness, fibrousness, grittiness, mealiness, stickiness, oiliness are essentially sensed by the muscular force applied in the process of mastication and are considered part of texture. Objective measurements of texture can be done using a texturometer. The basic system of texturometer is that of a plunger, which compresses the sample at a standard rate, the forces developed being measured by means of a strain gauge. The texture of the frozen product on thawing depends upon the freezing rate, time, temperature and relative humidity of the storage, the conditions of thawing and the composition of food. Texture deterioration, which occurs in fish upon freezing, is due to denaturation of protein.

Sensory Testing Methods

Testing Laboratory

Location, laboratory layout, odour control, lighting and general comfort are the important physical conditions in setting up a laboratory. The laboratory should be located in such a place so that the majority of test subjects can reach there conveniently with a minimum of disturbance in normal work routines. The area should be calm to avoid disturbance of tests. The testing area should be divided into two parts, one a work area and the other for the actual testing. Individual panel booths are essential to avoid mutual distraction among test subjects. The testing area must be kept

as free from odours as possible. All materials and equipment in the test room should be either odour free or have a low odour level. The testing room should have comfortable and adequate level of illumination. There should be an atmosphere of comfort and relaxation to encourage panel members to concentrate on the testing tasks.

Selection of Sensory Panel

Panel members are selected by evaluating the ability of an individual to distinguish, discriminate and quantify various sensory attributes. The panel members are usually required to deal with complex stimuli: hence any series of taste on simple stimuli will partially determine a person's value. It is necessary to take into consideration all the factors that may affect performance. This can be done by using representative tests on representative samples. The selection process will be started with a large group of persons, since the larger the number of candidates, the greater the probability of finding persons of superior ability. Sometimes it is possible to find persons of superior ability in unexpected quarters. Requalification of all panel members is required periodically.

Presentation of Samples

The samples shall be presented in such a manner that the panel members will respond only on the basis of those factors, which are intrinsic to the material tested. The key is uniformity, particularly within a given test. Important factors to consider are quantity of sample, the containers, eating utensils and temperature

Sensory Testing Methods

Several sensory evaluation methods have been developed. Each method has its own advantages and disadvantages. The experimenter should be familiar with the merits

and demerits of each method. Most practical and efficient method should be selected depending on the situation. No single method can be used universally. There will be variation and changes in the method depending on the purpose of the test and the information needed.

There are three fundamental types of sensory testing methods

1. Preference/acceptance tests
2. Discriminatory tests
3. Descriptive tests

Preference tests are affective tests based on a measure of preference from which relative preference can be determined. Discriminative tests are used to determine whether a difference exists between samples. The panelist does not allow his personnel likes and dislikes to influence his response. Laboratory difference panels are used to determine if there is a difference among samples. Descriptive tests are used to determine the nature and intensity of the differences. The important

test methods used to measure subjectively the difference between samples are Triangle test, Simple paired comparisons test, Scheffe paired comparisons test, Duo-trio test, Multiple comparisons test, Ranking, Scoring and Ratio scaling. In the descriptive sensory analysis, a group of highly trained panelists examine a particular property of a product to provide a detailed descriptive evaluation of it. The most commonly known descriptive methods are the flavour profile and the texture profile. The flavour profile is the description of the taste and odour of a product.

Demerit freshness quality grading system has several unique characteristics. Here the various sensory factors associated with different organs of fish like skin, eyes, gills, belly, vent during postmortem changes are described and graded from 0 for extremely fresh and the demerit score is increasing as spoilage advances. The number of scores for each factor is given based on its contribution towards spoilage. The following is a demerit system developed by Branch and Veil (1985) having a total demerit score of 39.

Table. 1 Freshness Quality Assessment system for fresh fish

Factor Being Assessed	Observed characteristics	Demerit Points
Appearance of surface	Very bright	0
	Bright	1
	Slightly dull	2
	Dull	3
Skin	Firm	0
	Soft	1
Scales	Firm	0
	Slightly loose	1
	Loose	2
Slime	Absent	0
	Slightly slimy	1
	Slimy	2
	Very slimy	3

Stiffness	Prerigor	0
	Rigor	1
	Postrigor	2
Eyes clarity	Clear	0
	Slightly cloudy	1
	Cloudy	2
Shape	Normal	0
	Slightly sunken	1
	Sunken	2
Iris	Visible	0
	Not visible	1
Blood	No blood	0
	Slightly bloody	1
	Very bloody	2

Gills Colour	Characteristic	0
	Slightly dark/ slightly faded	1
	Very dark/very faded	2
Mucus	Absent	0
	Moderate	1
	Excessive	2
Smell	Fresh oily/fresh seaweedy	0
	Fishy	1
	Stale	2
	Spoiled	3
Belly Discolouration	Absent	0
	Detectable	1
	Moderate	2
	Excessive	3
Firmness	Firm	0
	Soft	1
	Burst	2
Vent Condition	Normal	0
	Slight break/ exudes	1
	Excessive/ Opening	2
Smell	Fresh	0
	Neutral	1
	Fishy	2
	Spoiled	3
Belly cavity stains	Opalescent	0
	Grayish	1
	Yellow-brown	2
Blood	Red	0
	Dark red	1
	Brown	2
Total demerit points (0-39)		

The advantage of such system is that the sensory examiner is exposed to minimum confusion since every description of each demerit point is very brief, usually involving one or two words.

In this system it is important to ensure that all the specified questions concerning sensory characteristics will be answered. A fish sample cannot be rejected on the basis of a single criterion since no undue importance is placed on a single feature. The minor differences in the judgments in any of the criterion being assessed do not unduly influence the total score. The demerit score given in the Table may be modified depending on the species giving due importance to the spoilage factors.

Hedonic Scale

The most commonly used scale for preference testing is the nine-point hedonic scale. The term "hedonic" is defined as "having to do with pleasure". Here the panelist expresses his degree of liking or disliking.

The Hedonic scale most commonly used are given below

- Like extremely 9
- Like very much 8
- Like moderately 7
- Like slightly 6
- Neither like nor dislike 5
- Dislike slightly 4
- Dislike moderately 3
- Dislike very much 2
- Dislike extremely 1