UNIT 10 SELECTION AND TRAINING OF SENSORY PANELISTS AND METHODS OF SENSORY EVALUATION

Structure

10.0 Objectives
10.1 Introduction
10.2 Types of Sensory Panelists
10.3 Screening, Selection, and Training of Sensory Panelists
   1. Qualifications for Screening a Panelist
   1. Screening and Selection
   1. Training
10.4 Sensory Methods
   1. Difference or Discriminative Testing
   1. Scoring
   1. Ranking
   1. Hedonic Scaling Rating
   1. Descriptive Analysis
   1. Preference / Acceptance Testing
10.5 Consumer Evaluation
10.6 Sample Preparation for Training
10.7 Let Us Sum Up
10.8 Key Words
10.9 Some Useful Books
10.10 Answers to check your Progress Exercises

10.0 OBJECTIVES

After reading this unit we should be able to:

- Select and train different types of sensory panel;
- Implement various sensory methods for judging of dairy products;
- Conduct the consumer studies; and
- Prepare the samples with different attributes for training sensory panelists.

10.1 INTRODUCTION

We have learnt in Unit 1 the definition of sensory evaluation and its uses, the
primary senses and their role in evaluating the quality of a food, and the design and requirements of a sensory laboratory. We also understood that consumers accept or reject a food product on the basis of eating quality that includes aroma, taste, texture, colour and appearance. They evaluate these attributes with the help of their primary senses. Therefore, it is inevitable that, modern food processing units should examine the quality of food before packaging and marketing their products adopting the same analytical tools, i.e. sensory methods.

Analysis of sensory properties of food involves the use of human subjects in the laboratory/processing plant environment. The sensitivity and experience of an evaluator (panelist) influence the accuracy of results. The evaluator should work like a calibrated instrument and provide reproducible results. The selection of most stable and sensitive panel members and their training, is therefore, very essential for efficient conduct of sensory analysis of dairy products.

10.2 TYPES OF SENSORY PANELISTS

The sensory panels are classified into three categories viz., trained, semi trained and consumer panel. The panelists are selected and trained by the sensory leader/coordinator depending on the type of the product.

i) **Trained Panel**: They should be carefully selected and trained, and need not be expert panelists. The trained panel should be used to establish the intensity of a sensory character or overall quality of a food. A trained panel should comprise of small number of members varying from 5 to 10 and may be used in all developmental, processing and storage studies. A small highly trained panel will give more reliable results than a large untrained panel.

ii) **Semi-Trained Panel (D&C Panel)**: This type of panel should be constituted from persons normally familiar with quality of milk and different classes of dairy products. This panel is capable of discriminating differences and communicating their reactions, though it may not have been formally trained. In a semi-trained panel individual variations can be balanced out by involving greater number of panelists. The panel, should normally consist of about 25 to 30 members, and should be used as a preliminary screening programme to select a few products for large scale consumer trials.

iii) **Consumer Panel**: The members of the consumer or untrained panel should be selected at random and ensure due representation to different age, sex, race and income groups in the potential consumer population in the market area. More than 80 members are required to constitute a consumer panel.

10.3 SCREENING, SELECTION AND TRAINING OF SENSORY PANELISTS

Two channels can be adopted for screening and selection of sensory panel members. First, from the quality control laboratory, and second source is from the processing unit. Another option is to have a mixed source i.e. some of the members from quality control laboratory and the remaining from processing sections. Normally double the numbers of panelists finally required are selected. For example, if 7 members are needed in the final panel at least 15 should be initially screened.
i. Qualification for Screening a Panelist

*Interest and motivation:* Candidates who are interested in sensory analysis and have investigating curiosity are likely to be more motivated and will do better jobs.

*Attitudes to foods:* Candidates having strong liking or disliking towards a dairy product should not be screened.

*Knowledge and aptitude:* The evaluators should have capacity to concentrate and to remain unaffected by external influences. He should have knowledge about basic aspects and principles of milk and its processing into products.

*Health:* Candidates should be in good general health. They shall not suffer from any disabilities, which may affect their senses, or from any allergies or illness and shall not take medication, which might impair their sensory capacities.

*Ability to Communicate:* The ability of candidates to communicate and describe the sensations they perceive when judging a food product is particularly important.

*Availability:* Candidates shall be available to attend both training and subsequent evaluation. Personnel who travel frequently or have heavy workloads are often unsuited for sensory work.

ii. Screening and Selection

Sensory panelists can be screened and selected by adopting several tests. The followings are the most commonly used tests:

1. determine impairment of primary senses (colour, vision, ageusia and anosmia)
2. matching test for taste and odour substances
3. ability to detect basic taste and odour acuity
4. determine ability to characterized texture
5. performance in comparison with other candidates

a) *Colour Vision:* Candidates with abnormal colour vision or colour blindness are unsuitable for judging of dairy products. Assessment of colour vision can be carried out by a qualified optician.

b) *Matching Test:* Samples of sapid and/ or olfactory materials, depending on the nature of product for which the panel members are to be trained later, at well above threshold levels of the expected panelists are prepared. The examples of these materials are given in table 10.1. Each sample is allotted a different, random, three digit code number. Candidates are presented with one sample of each type and are allowed to familiarize themselves with them. They are then presented with a series of the same materials labelled with different code numbers. They may be asked to match each of them with one of the original set and describe the sensation they are experiencing. For the substances and their concentration given in table 10.1, candidates who make less than 80% correct answers should not be chosen as selected panelists.
Table 10.1  Examples of materials/substances and their concentration for identification/matching test

<table>
<thead>
<tr>
<th>Taste or Odour</th>
<th>Material</th>
<th>Concentration in water (taste material) or ethanol* (odorous material) at room temperature (g/litre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taste</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet</td>
<td>Sucrose</td>
<td>16</td>
</tr>
<tr>
<td>Acid/sour</td>
<td>Tartaric acid or citric acid</td>
<td>1</td>
</tr>
<tr>
<td>Bitter</td>
<td>Caffeine</td>
<td>0.5</td>
</tr>
<tr>
<td>Salty</td>
<td>Sodium chloride</td>
<td>5</td>
</tr>
<tr>
<td>Astringent</td>
<td>Tannic acid or quercitin or potassium aluminium sulfate (alum)</td>
<td>1</td>
</tr>
<tr>
<td>Metallic</td>
<td>Ferrous sulfate**, hydrates, FeSO₄·7H₂O</td>
<td>0.01</td>
</tr>
<tr>
<td>Odour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lemon, fresh</td>
<td>Citral (C₁₀H₁₅O)</td>
<td>1 x 10⁻³</td>
</tr>
<tr>
<td>Vanilla</td>
<td>Vanillin (C₈H₈O₃)</td>
<td>1 x 10⁻³</td>
</tr>
<tr>
<td>Thyme</td>
<td>Thymol (C₁₀H₁₄O)</td>
<td>5 x 10⁻⁴</td>
</tr>
<tr>
<td>Floral, Jasmine</td>
<td>Benzyl acetate (C₈H₁₂O₂)</td>
<td>1 x 10⁻³</td>
</tr>
</tbody>
</table>

* Stock solutions are prepared with ethanol, but the final dilution is made with water and shall not contain more than 2% of alcohol.

** To mask yellow colour, present the solutions in closed opaque containers or under dim or colouring light.

c) Test for Detection of Basic Taste: Solutions of four basic taste solutions, namely sweet, sour, salt and bitter are prepared of the concentration as shown in table 10.2 below:

Table 10.2 Concentration of Taste Solutions Used to Examine the Acuity of Candidates

<table>
<thead>
<tr>
<th>Material</th>
<th>Taste Quality</th>
<th>Concentration in water at room temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caffeine</td>
<td>Bitter</td>
<td>0.27 g/ litre</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>Sour</td>
<td>0.60 g/ litre</td>
</tr>
<tr>
<td>Sodium Chloride</td>
<td>Salt</td>
<td>2 g/ litre</td>
</tr>
<tr>
<td>Sucrose</td>
<td>Sweet</td>
<td>12 g/ litre</td>
</tr>
</tbody>
</table>

These test materials along with blank (water) are presented to the candidates and asked them to detect the taste quality. Preferably candidates should have 100% correct responses as the concentrations test materials are at the super threshold.
level. Inability to detect differences and identify the taste quality after several repetitions indicate that the candidates have poor sensitivity and are unsuitable to judge the samples on the basis of taste.

d) **Odour Recognition Test**: Candidates are presented many (about 10 in each lot) odoriferous substances. Some of these materials are familiar (those we use daily such as tea, coffee, onion, garlic, curd, orange, spices, etc.) and others unfamiliar (table 10.3). The odorous food materials may be presented preferably in form of liquid extract or as such (in a test tube in invisible form). The concentration should be above the recommended threshold level. Candidates are graded according to correct answers. Those recognize less than 65% of odorous substances/odour are unsuitable as panelist for this type of test.

Table 10.3 Examples of Unfamiliar Odorous Material for Odour Recognition Test

<table>
<thead>
<tr>
<th>Material</th>
<th>Name most commonly associated with the odour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzaldehyde</td>
<td>Bitter almonds, cherry, ……</td>
</tr>
<tr>
<td>Octene-3-Ol</td>
<td>Mushroom, ……</td>
</tr>
<tr>
<td>Phenyl-2-ethyl acetate</td>
<td>Floral, ……</td>
</tr>
<tr>
<td>Diallyl sulphide</td>
<td>Garlic, ……</td>
</tr>
<tr>
<td>Camphor</td>
<td>Camphor, medicine, ……</td>
</tr>
<tr>
<td>Menthol</td>
<td>Peppermint, ……</td>
</tr>
<tr>
<td>Butyric acid</td>
<td>Rancid butter, ……</td>
</tr>
<tr>
<td>Acetic acid</td>
<td>Vinegar, ……</td>
</tr>
<tr>
<td>Isoamyl acetate</td>
<td>Fruit, banana, ……</td>
</tr>
<tr>
<td>Thymol</td>
<td>Spices, ……</td>
</tr>
<tr>
<td>Vanillin</td>
<td>Vanilla, ……</td>
</tr>
</tbody>
</table>

e) **Textural Characterization**: This type of test is highly beneficial for selecting the panelists for judging the dairy products where texture is an important attribute like cheese, paneer, butter, ice cream, khoa etc. In this test, all range of products having typical texture (table 10.4) is given to the candidates. They have to arrange these products according to the nature and level of textural properties, such as hard, elastic (spongy), adhesive (sticky/pasty), brittle, gummy, cohesive, chewy etc. A satisfactory level of success in this task can be specified only in relation to the products used. Candidates who achieve less than 65% of the maximum score are unsuitable.

Table 10.4: Food Products with Typical Textural Attributes

<table>
<thead>
<tr>
<th>Food product</th>
<th>Textural attribute most commonly associated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrot (raw)</td>
<td>Hard, crunchy</td>
</tr>
<tr>
<td>Butter</td>
<td>Soft</td>
</tr>
<tr>
<td>Toffee</td>
<td>Gummy</td>
</tr>
</tbody>
</table>
iii. Training

The purpose of training is to increase sensory acuity of panelists and provide them with rudimentary knowledge of procedures used in sensory evaluation. Training also develops the ability of panel members to detect, recognize, and describe sensory stimuli related to dairy products. A general step-wise approach for training in dairy product is summarized as below.

a) Sensory panelists (assessors or evaluators) should be explained the basic requirements of sensory evaluation i.e. what they should do and what not to do (already explained in Unit 1).

b) Assessors shall be acquainted with the:
   - desirable and undesirable attributes of the product
   - correct terminology
   - use of score card
   - scoring technique/sequence of observations

c) Samples used for training and testing shall be characteristic of their origin, style and quality, and representative of the range generally found in the market (all defects may be simulated in the samples under laboratory conditions). Always provide a reference (having most desirable characters) with test samples.

d) Adjust the difficulties of the test so that the group as a whole will find difference between the samples, but some panelists will fail.

e) Start with the large group and reject those who are insensitive or under perform.

f) Finally a trained panel comprising of 5-6 members is retained.

Check Your Progress – 1

1) Write the types of sensory panel and number of evaluators in each.

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
2) What should be the qualification of a sensory panelist?

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

3) Write the tests that you will adopt for selection of sensory panelists.

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

10.4 SENSORY METHODS

Generally following sensory tests are adopted under different conditions.

1. Difference or discriminative tests

1. Scoring

1. Ranking

1. Hedonic scale

1. Descriptive analysis

1. Acceptance and preference test

i. Difference or Discriminative Testing

Difference test is one of the most useful sensory tests. It is generally used for selection and training of sensory panelists. Difference test is designed to discriminate difference between two or more samples. Within this general class are a variety of specific methods, viz., paired comparison, duo-trio, triangle and multiple sample tests. The main features of these difference tests are discussed here.

a) Paired Comparison Test: It is a two products (e.g. A & B) test, and the panelist’s job is to compare these and identify whether the samples are similar of different. If different, which attribute, such as sweetness, acidity, hardness, colour etc. is responsible for this difference. This part of the test is called as directional difference test. The test can be further extended and the preference component of the panelist can be included. The paired comparison test is relatively easy to organize and implement. The two coded samples in order of AA, BB, AB, BA (4 pairs) are served simultaneously, and panelist has to decide if there is any difference or not. Paired comparison is typically used in comparing new and old processing techniques, change of ingredients in a product, preference testing at the consumer level, etc.

b) Duo-trio Test: This test is a modified paired comparison test. One sample identified as the reference (R) is first given to the panelists for evaluation.
Sensory Evaluation

Subsequently two coded samples, one of which is identical to reference, are presented. The panelist is asked to indicate, which of the two samples is the same as ‘R’. The test is suitable for products that have relatively intense odour, taste and/or kinesthetic effects such that sensitivity of evaluator is significantly reduced. It is used for quality control and for selection of panelists.

c) Triangle Test: Triangle test is most well known and more frequently used out of the three difference tests. As its name implies, it is a three product test in which all the samples are coded and the panelist’s task is to determine which two are most similar or which one is most different from the other two. Triangle test is more difficult test because the panelist must recall the sensory characteristics of two products before evaluating the third and then make a decision. It should, therefore, preferably be used by trained panel for quality control work, and also for further training of panelists.

d) Multiple Sample Test: Test involving more than 3 stimuli are classified as multiple sample tests. They may have equal (symmetrical) or unequal (asymmetrical) numbers of each stimulus. When they are applied as true difference tests, the judge is required to separate the sample into two groups of like samples. When they are applied as directional tests, the judge is asked to identify the groups of higher or lower intensity of a given criterion. Difference test designs involving more than three stimuli have only limited use. The limitation is due to the increase in psychological complexity and physiological fatigue, which accompanies an increase in number of stimuli. In addition, large quantities of samples are required and more time is needed. Multiple sample test is more applicable to visual differentiation and also to odour evaluation.

ii. Scoring

Certain weightage or score is given to each sensory attribute arranged in logical order on a score sheet in this method. The weightage is given on the basis of importance of the attribute. For example, flavour is considered to be most important and highest score is allotted to this attribute. The scoring method is most extensively used by the dairy industry (score cards of many dairy products will be given in Unit 3). Score cards wherein 10 to 100 total points have been allotted to different quality attributes are in use for dairy and food products. Scoring method is most frequently used amongst all sensory methods because of its diversity, simplicity and ease of statistical analysis. The most attractive feature of this method is that rigorous training is not required for panelists as information on defects and scoring guide is also provided on the scorecard.

iii. Ranking

In ranking method two or more samples are provided to the panelists who are asked to arrange them in an ascending or descending order of intensity of a specific attribute, e.g. sweetness. Ranking is often used for screening inferior from superior samples in product development. This method is also suited for comparison of market samples of different brands and ranking them first, second and so on. Samples may be ranked in order of degree of acceptability or in order of general quality or by a specific attribute. Example of ranking 5 samples of spongy Rasogolla is given below.
Sample codes, 237, 255, 287, 291 and 296

<table>
<thead>
<tr>
<th>Rank</th>
<th>Sample code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>287</td>
</tr>
<tr>
<td>2</td>
<td>296</td>
</tr>
<tr>
<td>3</td>
<td>237</td>
</tr>
<tr>
<td>4</td>
<td>291</td>
</tr>
<tr>
<td>5</td>
<td>255</td>
</tr>
</tbody>
</table>

So, using ranking test, Rasogolla with desired (optimum) sponginess can be selected. The ranking test is most effective if only one or two attributes are compared and the difference between samples is too large.

**iv. Hedonic Rating**

Hedonic relates to the psychology of pleasurable and non pleasant states of consciousness. In hedonic method, psychological states of like and dislike are measured on a rating scale. Normally rating scale has been categorized into five forms, viz. numerical, graphic, standard, cumulated points and forced choice forms. The Nine points numerical scale as given below has been most extensively used for new product development and consumer studies.

- 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

The above scale can be modified by assigning a numerical value of 0 to the indifferent category, with positive integers above and negative integers below this point. The use of positive and negative type of scoring can be effectively used by only trained panel. The hedonic scale provides following advantages:

1. Evaluators can respond to the queries without previous experience
2. Data can be handled statistically, and
3. Indicates general level of preference or liking for the samples

The only requirement for use of hedonic method is that large number of evaluators are needed to provide reliable responses or results.

**v. Descriptive Analysis**

Descriptive method of sensory evaluation provides quantitative descriptions of a
Sensory Evaluation

product based on the perception of a group of qualified judges. It is a total sensory description of a product taking into account all sensation that are perceived: visual, auditory, olfactory, gustatory, kinesthetic and so on. A descriptive method enables us to relate specific process variables to specific changes in some of the sensory attributes of a product, for example, the flavour changes in milk at high temperature processing. From the view point of product development, a descriptive information is essential in finding out those product variables that are different and from which one can establish the cause and effect relationships.

A descriptive test involves relatively few judges, who have been screened, selected and trained for the particular product category. Training of this group is primarily focused on development of descriptive language, which is used as a basis for scoring a new product, developing a definition of each attribute and familiarizing the judges with scoring procedures. There are numerous applications for descriptive analysis including monitoring competitions, storage stability/shelf life, product development, quality control, establishing physical/chemical and sensory correlation. Some of the popularly used descriptive method are Flavour profile, Texture profile, Quantitative descriptive analysis, etc.

vi. Acceptance/Preference Testing

Affective or acceptance testing is a valuable sensory technique, usually performed at consumer’s levels. It refers to measuring liking or preference for a product. Preference can be measured directly by comparison of two or more products with each other. Indirect measurement of preference is achieved by determining which product has scored significantly higher rating than another product in a multi product test. The two methods most frequently used to directly measure preference and acceptance are the paired comparison test and a 9-points hedonic scale. Both these methods have been discussed earlier.

10.5 CONSUMER EVALUATION

With the increase in competition, availability of many brands of same product in the market and the choice of consumers, it is highly desirable for the food/dairy industry to study the acceptance/preference and needs of consumers. In some cases it is possible to create markets for certain dairy products when none existed earlier. In many other situations, such as alterations in existing formulations, change in packaging materials, use of some additives or adoption of a new technology, the food processor has to go to consumers with their product to study their acceptance/preference. While conducting the consumer studies, the sensory leader/organizer should consider all the factors that are important in achieving the desired results. Some of these factors are: clear objectives, target population, start and completion dates, representative test samples, number of products number of responses per sampling, sample coding procedures, questionnaire, instruction on serving and pre-screening, data analysis and processing procedure, and proposed reporting schedule. As far as preference and acceptance of consumers is concerned the factors are grouped into two categories viz. 1) the attitude of the dairy product and 2) of the consumer.

a) **Attitude of the Dairy Product**: This is related to the product itself in respect of availability; utility; convenience; price; storage stability/requirements; safety and nutritional value; and sensory properties, which of course is very important.
b) **Attitude of the Consumer**: Religion preference; nationality and race; age and sex; education, socio-economics; psychological motivation such as symbolism of food, advertising, etc. and physiological motivation, such as thirst, hunger, deficiencies and pathological conditions.

While designing consumer studies and interpreting the results, the role of above factors may be considered.

c) **Questionnaire for Consumer Studies**: A well developed questionnaire for obtaining desired information, including preference, from the consumers is very important. The important considerations for developing a questionnaire are that it should be:

1. simple and clear
2. realistic
3. use appropriate terms
4. avoid stereotype answers

One example of such a questionnaire for seeking consumer opinion on Control milk sample (A) and on experimental milk sample fortified with Vit A. (B) is given below:

1. Prefer sample A……………
   Prefer sample B ……………
2. Why do you prefer the sample of your choice (Tick mark one or more):
   Preferred milk sample has
   Richer taste …………….
   Sweeter taste …………….
   Smoother body …………….
   Rich consistency …………….
   Other ……………
3. If you prefer to buy the preferred sample, how much more (if any) per litre would you be willing to pay:
   25 paise …………….
   50 paise …………….
   Re. 1 …………….
   None ……………

The above questionnaire shows the relationship between preference for milk and willingness to pay more for the preferred sample.
Check Your Progress – 2

1) List the different methods used for sensory evaluation of food products. Which of these tests is most commonly used for judging of dairy products and why?

……………………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………………

2) What is the main objective of considering discriminative method? Name the different discriminative tests and discuss the one which is most popular.

……………………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………………

3) Define hedonic rating method and give the 9-point hedonic scale.

……………………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………………

4) What are the objectives of conducting consumer studies? Name the factors related to attitude of dairy product that affect the consumer studies?

……………………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………………
……………………………………………………………………………………………………………………………………

10.6 SAMPLE PREPARATION FOR TRAINING

For accurate judging of the sensory quality of dairy products, it is necessary that the evaluator has the awareness of desirable attributes and likely defects in them. The sensory panelists are provided a control sample along with other samples having all possible defects. Under real situation it may not be possible to procure all such defective samples from either a processing plant or from the market. Various defects, particularly the flavour defects in dairy products have, therefore, to be simulated in the laboratory to impart meaningful training to the panel members. The most common flavour defects of dairy products and causes for the same are given below:

<table>
<thead>
<tr>
<th>Cause</th>
<th>Related Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heated</td>
<td>Cooked, burnt, caramelized, scorched, powdery</td>
</tr>
</tbody>
</table>
Selection and Training of Sensory Panelists and Methods of Sensory Evaluation

| Light induced | - Light, sunlight, activated |
| Lipolysis of butter fat | - Rancid, butyric, bitter, goaty |
| Microbial | - Acid, bitter, fruity, malty, putrid |
| Oxidation of fat | - Papery, cardboardy, oxidized, oily, fishy, metallic |
| Transmitted | - Feed, weed, cowy, barny |
| Miscellaneous | - Chemical, flat, foreign, lack freshness (stale), salty |

**i) Simulation of Different Flavour Defects in Milk and Milk Products:**
The flavour defects and their preparation, which are of general nature and found in most of dairy products, are discussed here.

**ii) Cooked Flavour:** When milk and milk products are heated beyond minimum conditions of heating (>76.7°C) the flavour properties are generally altered. This flavour alteration is called cooked. In fact cooked is a generic name that is applied to heat induced flavour defect described as heated, nutty, burnt, scorched and caramel. The type of these developed flavours depends on the intensity of heat treatment, the time of exposure, composition of dairy product and extent of burn-on the heating surfaces. The cooked flavour is desirable to some extent in milk and many dairy products, but its higher intensity is undesirable.

Cooked and related off flavours in milk and milk products can be simulated simply by heating them at a temperature higher than that recommended for their processing.

**iii) Light Induced and Sunlight Off-Flavour:** This defect is more common in milk and develops due to exposure of milk to sunlight or extended exposure to fluorescent light. The related terms of light activated off flavour are cabbage-like, mushroom-like, burnt protein, chemical like or burnt feather. Methionine amino acid is degraded by the light in the presence of riboflavin, into methional, which imparts the light induced off-flavour.

For simulation of sun light off-flavour, expose capped milk sample bottles to direct sunlight ranging from 30 min to 3 hours, depending on the intensity of off-flavour needed.

**iv) Oxidized Off Flavour:** An oxidized off flavour results from the action of oxygen on certain compounds of milk fat (particularly unsaturated fatty acids) and reaction is catalyzed by divalent cations (copper and iron). The end products are short chain volatile aldehyde/ketones. The flavour sensation produced are: cardboardy, cappy, tallowy, fishy and oily. Samples with this defect can be prepared by bubbling oxygen gas from a cylinder for 10 to 20 minutes or by excessive agitation and storage at 37°C.

**v) Metallic:** This off flavour is due to prolonged exposure of milk and dairy products to metal surfaces, like iron, copper, etc. Initially the product gives perception of a rusted iron nail, but on longer storage this results into oxidized off-flavour.

Prepare a 0.3% solution of ferrous sulphate in distilled water. Add 0.5 to 2 ml of this solution to 500 ml milk or equivalent amount of product to simulate varying degree of metallic flavour.
vi) **Rancid Off-Flavour**: Also called as hydrolytic rancidity, this off flavour results due to hydrolysis of triglycerides and diglycerides of milk fat by action of lipase enzyme. The end products of the reaction are short chain fatty acids (butyric, caproic and caprylic) and their salts. The sensory perceptions of the flavour defects are: soapy, bitter, goaty, butyric.

For simulation of rancid off-flavour add lipase solution (50 mg dissolved in 10 ml distilled water) to milk or other products @ 0.5 to 2 ml/100 gm and incubate for 1 to 2 hr. In case of milk incubate for about 24 hours at 10°C. Alternatively homogenize raw milk or cream and leave for some time to develop rancid defect.

vii) **Acidic/Sour**: High acid is probably the most commonly occurring flavour defect in milk and dairy products under Indian conditions. This is usually due to uncontrolled growth of lactic acid fermenting bacteria at room temperature.

Undesirable acidic/sour defect can be developed by storing the samples at room temperature (preferably 37°C) for different periods.

viii) **Flat or Lack of Flavour**: Flat suggests different meaning to different products. For milk, flat denotes lack of richness or mouth feel and simply prepared by adding water @ 20-25% to milk or removing cream from milk. In case of other products flatness means lacking in typical pleasant flavour. Accordingly flat samples may be prepared by reducing the fat content (khoa and paneer), insufficient heating of raw material (khoa and ghee), excessive washing of butter grains (table butter) and improper ripening of curd (cheddar cheese).

ix) **Bitter Off Flavour**: Bitterness in dairy products is produced due to excessive rancidity or by certain weeds or by some psychrotrophic bacteria. Proteolysis results into low molecular weight protein fragments (peptides and some amino acids), which are responsible for bitter flavour in cheeses.

Bitter samples of milk and dairy products may be prepared by adding 1-2 ml of 1% quinine sulphate solution to about 1 kg of milk/product. The quantity can be changed depending on the intensity of bitterness required.

x) **Astringency Defect**: This is a textual sensation (perceived by the sense of touch) but is detected only when the sample is put into mouth. Other descriptions of astringency defect include: mouth coating, dry, puckery, chalky. Alum exhibits extreme astringency defect. So for preparing samples of astringency defect, aqueous solution of alum (aluminum sulfate 0.5% or more may be added depending on the intensity required) should be added.

xi) **Other Off-Flavour**: Some other flavour defects typical to a dairy products will be discussed separately in Unit 3.

**Check Your Progress – 3**

1) List the most common flavour defects of milk and dairy products and write one main cause of the each.

..............................................................................................................................
..............................................................................................................................
2) Write the purpose of developing off-flavours in milk samples under laboratory conditions?

3) How you will simulate following flavours defects in milk?
   a) Oxidized: _______________________________________
   b) Acidic/sour: _____________________________________
   c) Rancid: _________________________________________
   d) Burnt: _________________________________________

10.7 LET US SUM UP

Sensory properties viz. aroma, taste, texture, consistency, colour and appearance are measured under laboratory/processing/household conditions by the human subjects (sensory panelists). These are grouped into three categories, namely, trained, semi-trained and consumer panel. The first two categories are used under the laboratory/processing plant situation for either research and development work or for routine manufacture of dairy products. The consumer panel is used for evaluating the acceptability of a dairy product in the market.

The sensitivity and reproducibility of panelists influence the accuracy of results. The trained panel should, therefore, be properly selected and trained for a particular dairy products category. Screening and selection of panel members (judges) is made on the basis of their sensitivity in respect of basic tastes and odours recognition, characterization of textural attributes and performance in comparison with other members. Training is imparted in the concerned product by including control samples (ideal product) and those having all range of flavour, body & texture and appearance defects. The members should be acquainted with the use of right type of sensory test, scorecard and terminology. Numerous tests are available for sensory analysis of dairy and other food products. The most frequently used tests are: discriminative tests (paired comparison, duo-trio, triangle and multiple samples tests), scoring, ranking, descriptive (flavour profile, texture profile and QDA), hedonic rating, acceptance/performance testing. For successful marketing of a new product or existing products, which have been altered in respect of mix formulation, use of new ingredients/additives, packaging, extended shelf life, etc, the consumers evaluation studies are highly beneficial. Preparation of samples with desirable and undesirable (defects) attributes for imparting rigorous training to the sensory panelists is very important and can be done in the laboratory.
### 10.8 KEY WORDS

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptance</td>
<td>An experience, or feature of experience characterized by a positive (approaching a pleasant) attitude.</td>
</tr>
<tr>
<td>Acuity</td>
<td>Ability to discern or perceive stimuli; sharpness or acuteness.</td>
</tr>
<tr>
<td>Ageusia</td>
<td>Disorder of the sense of taste in which no taste is perceived.</td>
</tr>
<tr>
<td>Amosmia</td>
<td>Disorder of the sense of smell in which odour are perceived even when none is present or no odour is perceived when an odour is present.</td>
</tr>
<tr>
<td>Appearance</td>
<td>This visual property of a food, including size, shape, colour and conformation.</td>
</tr>
<tr>
<td>Assessment</td>
<td>A judgment or an evaluation.</td>
</tr>
<tr>
<td>Attribute</td>
<td>Classification of individual units as acceptable or unacceptable.</td>
</tr>
<tr>
<td>Body</td>
<td>The quality of food or beverage, relating variously to its consistency, compactness of texture, fullness, or richness.</td>
</tr>
<tr>
<td>Flavour</td>
<td>Total of sensory sensations perceived at the entrance of the alimentary and respiratory tract, consequently mainly sum of odour and taste, sometimes coupled with warmth, cold and mild pain.</td>
</tr>
<tr>
<td>Hedonic</td>
<td>Pertaining to pleasurable or unpleasurable experiences.</td>
</tr>
<tr>
<td>Judge</td>
<td>Examiner with some experience and/or training regarding the test problem.</td>
</tr>
<tr>
<td>Matching</td>
<td>The process of equating or relating, pair by pair, for experimental purposes, usually to determine the degree of the similarity between a standard and an unknown, or two unknowns.</td>
</tr>
<tr>
<td>Odour</td>
<td>Impression derived by smelling or sniffing.</td>
</tr>
<tr>
<td>Palatable</td>
<td>Pleasing to the taste, and hence, acceptable.</td>
</tr>
<tr>
<td>Panel Leader</td>
<td>The person responsible for organizing, conducting, and directing a panel.</td>
</tr>
<tr>
<td>Panel</td>
<td>A group of people (assessor, subjects, judges) comprising a test population that has been specially selected or designated in some manner.</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Acuity; ability to perceive quantitative and/or qualitative differences.</td>
</tr>
</tbody>
</table>
Selection and Training of Sensory Panelists and Methods of Sensory Evaluation

Sensory : Pertaining to the action of the sense organs.
Smell : To perceive by excitation of the olfactory nerves.
Sniff : To evaluate an odour by drawing air audibly and abruptly through nose.
Taste Sensitizer : Substance which conditions the taste organs for keener perception.
Taste : Impression made by certain soluble substances in the mouth. Salty, sour, sweet and bitter are basic tastes.
Texture : Those properties of foodstuff, apprehended by the eyes and by the skin and muscle senses in the mouth, including roughness, smoothness and graininess.
Threshold : A statistically determined point on the stimulus scale at which occurs a transition in a series of sensations or judgments.

10.9 SOME USEFUL BOOKS


10.10 ANSWERS TO CHECK YOUR PROGRESS

Your answer should include the following points:

Check Your Progress - 1

1) a) trained panel – 5 to 7 members; b) semi trained – about 25 to 30; and c) consumer panel – more than 80

2) The prospective judges/panelists should have: interest and motivation; good health; knowledge and aptitude; able to concentrate and spend time; easy availability; and having neither too much liking nor disliking to the concerned dairy product.
Sensory Evaluation

3) Determination of physiological disability in respect of primary senses (colour vision, Ageusia, Anosmia)
   a) Sensitivity towards basic taste solutions (sweet, salty, acidic & bitter) and odours substances (lemon, vanilla, thymol, floral).
   b) Ability to characterize texture quality (hardness, springiness, adhesiveness, chewiness, gumminess, brittleness, etc.)
   c) Performance in comparison with other panelists.

Check Your Progress – 2

1) Discriminative testing; b) Scoring; c) Ranking; d) Descriptive analysis; e) Hedonic rating; f) Acceptance / preference.
   a) Scoring and Hedonic rating methods are more popular for judging of dairy products.

2) Discriminative testing is used to find out difference between two or more sample. Normally a control and a experimental sample is provided and panelist has to find out whether there is difference or not between these.
   a) Paired, duo-trio, triangle and multiple sample tests
   b) The most popular discriminative test is triangle test. In this three samples, out of which two are similar and one is different, are provided simultaneously. The panelist has to find out which is the odd sample and which two are similar.

3) Measurement of psychological states of likes and dislikes on a rating scale is defined as hedonic rating.
   a) 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

4) Objectives – Determine market potential; introduction of new product; quality assessment and control of a existing product altered in respect of composition, ingredients/additives, packaging, processing conditions, shelf life etc.; and acceptance at a particular cost.
   a) Factors related to attributes of product – availability, cost, utility, convenience, storage stability, safety and nutritional value, and sensory properties.

Check Your Progress – 3

1) Defect            Cause
   Sour / acidic      Microbial
   Oxidized           Oxidation of butter fat, non enzymatic
   Rancid             Hydrolysis of butter, enzymatic
Bitter Degradation of proteins in peptones, peptides and amino acids, also associated with rancidity & certain feeds.

Cooked Heating of milk at a temperature higher than pasteurization (more than 77°C).

Sun light Exposure to direct sun light

Barny/feed/weed Transmitted from unsanitary barn conditions; feeding of some feeds/weed just before milking

Stale/lack freshness Storage for a long time.

2) a) For proper training of judges, all types of samples (desirable and undesirable) are provided.

   b) During actual processing/manufacturing of products, it is not possible to develop these defects because of economic reasons.

   c) Samples with all types of defects are also not available in the market.

3) a) Oxidized - by blowing air into milk or by adding ferrous sulfate / copper sulfate to it; b) Acidic/Sour - keep milk (raw) at room temperature till souring starts; c) Rancid - Either add a lipase enzyme solution or homogenize raw milk; d) Burnt - heat milk to a temperature more than 77°C and don’t cool it immediately or while heating milk do not scrap the surface and let some milk bulk on the surface.