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## UNIT 6 SENSORY ANALYSIS OF FOODS/ BEVERAGES

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### 6.0 OBJECTIVES

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After reading this unit, you should be able to:

- differentiate between sensory analysis carried out by a trained panel and casual testing by consumers; and
- explain the methods that should be used in the two situations as both are important in analysing food/ beverage.

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### 6.1 INTRODUCTION

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Food / beverage quality is composed of four major components. They are: (i) Intrinsic factors as nutrition, safety which are hidden, (ii) economic factors as investment and profit for a producer (iii) sensory quality noticed by the people as colour, appearance, taste, flavour etc. and (iv) affective quality which decides its ultimate acceptance and use due to like/dislike to a product. The producer is most interested in the last two components to see repeat purchase and good sale of his product. Definite methods to test the intrinsic quality and cost benefit analysis are available for the first two components. These involve human responses and are often confused as one and same. At the outset it should be understood that the two are different. The sensory component testing refers to stimulation of sense organs (Iyendria) and it purely refers to responses

in analytical way. The consumer or affective test refers to response by a population, their like/dislike. It is a test for acceptance or rejection, preference or liking of a product (Indria) and not critical analysis.

The senses used in analysis of foods/ beverages by people are, the eye, which includes colour and appearance, the nose for the sense of smell/ aroma as felt by smelling or while swallowing the food, and by the tongue and interior of the mouth for the four basic tastes of sweet, sour, salt and bitter. The teeth while biting and feel on the tongue or by finger is another important sensory quality of food, as for example, softness of fruits, crispness of biscuit and papads etc. Figure 6.1 gives the idea of the sensations that foods create.

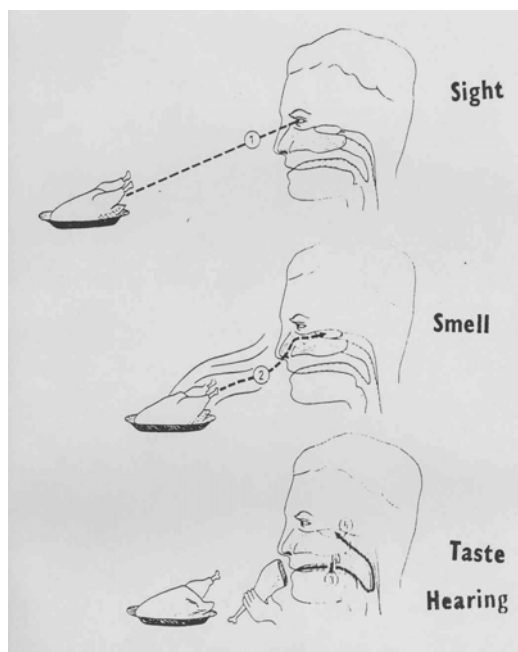


Figure 6.1: Sensory impressions by food

### 6.1.1 DEFINITION


Sensory analysis is a scientific discipline used to evoke, measure, analyse and interpret the reactions to food as perceived by sense of sight, taste, smell, touch and hearing. The sensory analyst will be equal to an analytical instrument, and will use his 'Iyendrias' (senses) as a tool. It is the 'Iyendria Moulya Maapan' only and not referring to personal likes and dislikes.

The ultimate use of food/beverage is achieved when people consume it. All human beings are endowed with sense organs and use them to judge colour, appearance taste, flavour and texture of food automatically. Is it not true we all look at the food we eat at home or outside for its sensory quality? Think and remember!!

However, this being a psychological response, it can be influenced by several factors. It is therefore important to test the product under careful conditions and in a scientific way.

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### Check Your Progress Exercise 1

-  **Note:** a) Use the space below for your answer.  
b) Compare your answers with those given at the end of the unit.

1. What are food qualities tested by people as tools called?
  - a) Intrinsic quality test
  - b) Economic quality test
  - c) Sensory quality test
  - d) Affective (consumer) qualities test

2. Give the definition of Sensory Analysis of foods.

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## 6.2 APPLICATION

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Sensory analysis tests are used in foods/beverages, personal care products as cosmetics, perfumes, and also in textiles for examination of texture, smoothness, etc. Sensory tests are needed in production, research centres and in consumer studies as in market research or survey. We all have seen sensory quality discussed in basmati rice, instant coffee, shampoo, soap etc.

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## 6.3 CONDUCTING SENSORY TESTS

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We know sensory tests are carried out by a panel leader and can be either analytical test done by trained people or as affective test done by consumers. The following remain common to both.

### 6.3.1 Identification of Problem

The first factor to be considered by panel leader is to identify the problem to be looked into i.e., aim of the test should be known. Since sensory organs are simulated simultaneously, for example, aroma and taste, colour and appearance, etc. the objective of testing has to be clear and focussed. The judge has to look for these attributes only.

### 6.3.2 Selection of Method

Sensory analysis testing for food quality valuation has been in practice from a long time. It has been used for complex products as tea and coffee, whisky by special blenders and also for simple products as sweetness by flow calorie sweeteners. The choice of test method, however, is very specific to the objective of testing. International and national standards are now available to use uniform pattern of testing. This is given in detail under 4.6.

### 6.3.3 Panellists

#### Panel Selection

The panel of judges for laboratory sensory testing are usually selected from people with normal sensitivity and not super tasters. They are from office, co-

workers in factory, research group and management staff. They are collected through circulars or personal contacts. People from both sexes are used. The eagerness to participate is the first requirement, as they have to be interested in it. Initial information on age, sex, health status, likes and dislikes, educational background, availability is necessary. In consumer tests, the target population should be selected. We have to see who uses the product and decides to buy it and they have to test it. For example chewing gum flavour is best tested by teenagers and quality of cooking oil by housewife.

### Panel Training

In laboratory sensory analysis, the level of training required depends on the type of test used. It is first done to select a group of people who are sensitive to the required level. For example, ability to test off odour has to be done by carefully selected and trained people. Where more intricate analysis is required, more training with examples are used. The panel leader will select the degree of training needed. In consumer tests, no specific training is given to panellists and only method to fill up the answer sheets/ pro forma will have to be explained.

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### Check Your Progress Exercise 2



**Note:** a) Use the space below for your answer.  
b) Compare your answers with those given at the end of the unit.

- |                                                   |     |    |
|---------------------------------------------------|-----|----|
| 1. Sensory tests are done only for foods.         | Yes | No |
| 2. Aim of testing should be clear first.          | Yes | No |
| 3. Panel members should be super tasters.         | Yes | No |
| 4. Which of the tests need more training and why? |     |    |

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## 6.4 FACTORS CAUSING BIAS IN SENSORY TESTS

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In sensory tests since human subjects are used as tools, care must be taken to use bias-free conditions. Bias means bad influence. Several difficulties can come up which will disturb the analysis and affect the results. They can be due to physiological factors or psychological factors.

### 6.4.1 Errors Due to Physiological Factors

Errors due to physiological reasons could be the following:

- i) *Health:* People with common cold cannot perceive smell and taste. Textural properties, particularly biting quality cannot be judged by people with artificial molar teeth.

- ii) Age is another factor which will influence sensory perception. With proper training and motivation it is possible to use panellists of all ages but care must be taken to avoid too young and too old age group.
- iii) Adaptation can occur in sensory in nose or tongue when a product is to be tested continuously. For example testing of pungent compounds or bitterness can make a panellist more tolerant of sensation in a product.
- iv) Enhancement of sensation can occur in some situations, for example perception of sweetness can be increased with some other substances as sourness. This is commonly observed in testing gooseberries or bitterness in coffee with added chicory.
- v) Suppression of taste sensation is the opposite effect of enhancement and commonly observed in foods. This effect will modify the taste sensation. This is observed in combination of pungent and salt tastes or even addition of oil or fat to a food.

### 6.4.2 Psychological Factors

In sensory testing, psychological factors play an important role. We all know each of us is capable of thinking and imagining. Some common psychological factors, which bias judgement, are as follows.

- i) Anticipatory or expectation errors. This occurs due to the panellist starting to test with a pre-conceived idea. Information received earlier can influence judgement. For example, this may happen in testing sweet tasting low calorie foods.
- ii) Stimulus error can occur due to other sensory impression in the same product, for example intense colour in fruit juice is considered strong in flavour. Even irrelevant issues can cause bias in judgement as packaging of product can give a bad influence.
- iii) Logical error can come up due to the imagination of panellist. For example, cakes with lot of holes may be expected to be soft and spongy or chapathi with brown spots will be considered soft and well cooked.
- iv) Halo effect is another situation of bias where the testing is to be done on 3 to 4 attributes and confuse the panellist if he/she is not careful.

In addition to these factors, testing sequence can also cause bias, as for example first sample tested will be seen critically. Over eagerness to perform well in tests or cross talk can influence the test. The panel leader should minimize these factors, which can bias judgement. The panellists should remain calm and interested to concentrate on the test.

In consumer tests, testing place as in a school or shopping area or home may be a bad influence if wrongly selected.

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## 6.5 PHYSICAL SET UP FOR CONDUCTING SENSORY TEST

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### 6.5.1 Laboratory Set Up

Three main areas are required for sensory testing of foods. They should be away from busy corridors and separated by wall or wooden partition. They are: (i) briefing room, where the panellist is told all about the product to be tested, testing method and number of samples (ii) testing room with table to keep the

samples and write the score card. Lighting and ventilation should be good. Each panellist should be separately seated and not in the visual reach of each other (iii) the third area should have sufficient place to keep all plates and cups used in test. All samples should be presented in uniform containers and coded numbers. Figure 6.2 gives a picture of a testing room in a laboratory set up.

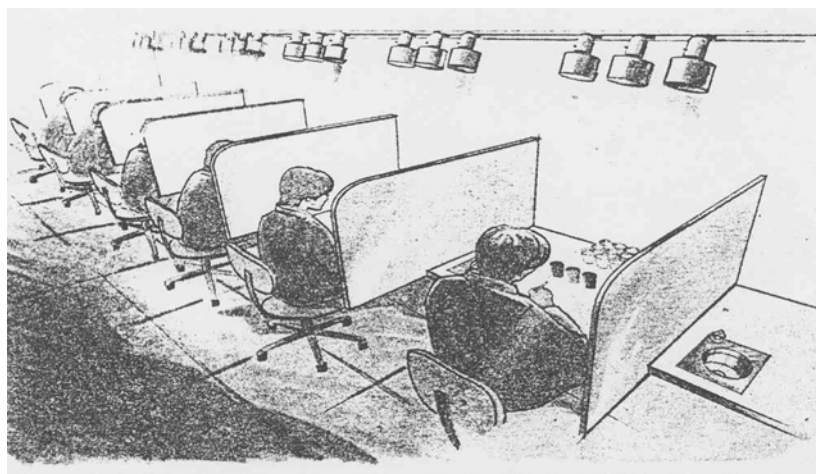


Figure 6.2: Laboratory setup for sensory testing

### 6.5.2 Consumer Testing

The physical set up depends on product and target group of consumers. It can be a central location testing in shopping area, college campus, hospital, etc.; it can be in club house or homes of friends. Essential requirement in all is to have similar cups and plates with code numbers for all products tested.

#### Check Your Progress Exercise 3



**Note:** a) Use the space below for your answer.  
b) Compare your answers with those given at the end of the unit.

1. Bias in sensory test (wrong influence can arise due to a) Physiological, b) Psychological factors.

Yes

No

Give two examples for both.

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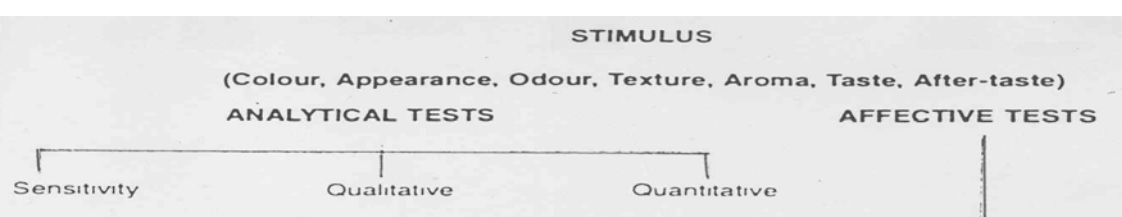
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## 6.6 SENSORY TEST METHODS

Bureau of Indian Standards follows the internationally standardised sensory test methods also. The Table 6.1 gives the test methods adopted. The first distinction is between analytical methods i.e., laboratory test method and second is the affective or consumer test method.

Table 6.1: Sensory testing methods



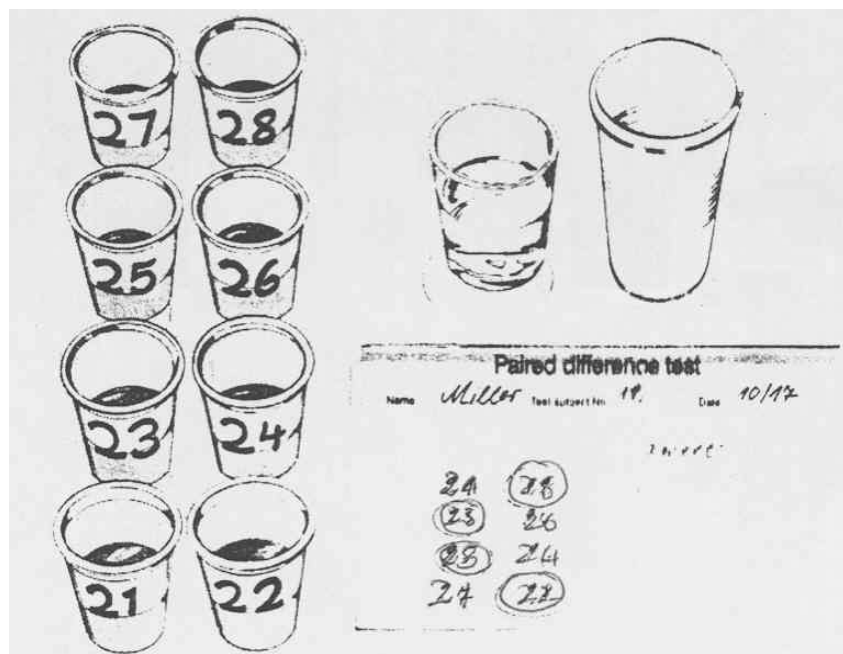
### 6.6.1 Analytical Tests

These are the laboratory methods used to test the product for its sensory quality.

#### Sensitivity Test

This refers to basic difference test. It can be performed as threshold test to identify a sensory impact. Threshold tests are used, for example, to select people with normal sensitivity to sweetness or saltiness. It can be used to detect adulteration. Samples are tested in a line till they find out the sensation.

Sensitivity tests can also be done as discriminative test in pairs or triangle. These two-sample tests are simple. We all know it is possible to compare one with just another easily without confusion. The order of examining, which is first? which is second? should be properly planned to avoid the bias that first is always best. For example, think of comparing a new orange drink with fresh juice. Paired test is by testing two samples at same time and see if they are same or different. Figure 6.3 shows how the samples are arranged. You will see 4 pairs of sample arranged for testing. Plain water is used in between samples. Only small quantity of test sample is given under coded numbers.



**Figure 6.3: Paired comparison test**

Minimum 7-10 panellists should examine the samples. Test results are checked for significance of difference by referring to statistical tables.

Triangle test is another method for difference test. The samples are presented in groups of three. Here two are identical and one is odd. The test is to identify the odd sample. For analysing the data, the total number of correct identification is counted and referred to table for significance of difference.

**Qualitative Tests**

Many times more than two samples will have to be tested for more attributes. For this qualitative tests can be used. This test is useful for working with semi-trained panel of 7-10 members. One of the methods is to arrange the tested foods in the order of increasing intensity (e.g. strong or weak aroma), or quality (e.g. good or bad aroma). Ranking is another method. For examples in chocolates, four to five brands can be tested for colour and appearance, texture, flavour and overall quality in one session. The panellist will have to arrange the samples in order of 1<sup>st</sup> rank for best colour then for best texture etc. Each attribute is tested separately. Classification method is another method. These can be for a specific category of sensory attributes for example as depth of yellowness in pineapple juice. The data in these tests is analysed using non-parametric method. The samples should be tested as coded samples and in random order to prevent bias.

**Quantitative Test**

In sensory tests to get information on 'how' and 'why' the foods are different, marks for the sensation felt has to be given. The panellists have to be trained more to do these tests and a minimum of 7 panellists are required. They have to be trained both to identify the sensation and give marks to it. This method is very useful for factory and research people. The methods are scoring, rating and time-intensity tests.

In scoring test, numbers as in figures or descriptive scores are used. These scores are useful when the panellists are well trained. For example in a product as jam, ketchup etc. scoring and grading for colour, consistency, set and aroma is useful. Similarly duration of sensory feeling can be matched with time-intensity as in natural and artificial sweeteners. The data is analysed for arithmetic mean and standard error. These quantitative tests can be tested further by detailed statistical tests. Indian standards institution has given details of these tests.

Quantitative description method, popularly called as QDA is another very useful methods for testing foods and beverages. It is a complete and detailed system of panel training, selection of range of products and vocabulary development in simple language. 8-10 well trained panellists can participate. For example description of Dosa or Samosa can be completely obtained and tested by this method. A reference can be maintained as a standard and any number can be tested by a panel. The method can be used to get difference, defects and desirable sensory quality. Recently available computer aided data analysis is very useful for testing.



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**Check Your Progress Exercise 4**

**Note:** a) Use the space below for your answer.  
b) Compare your answers with those given at the end of the unit.

1. Which are the two groups in sensitivity tests?

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2. For two samples ..... and ..... tests can be used.

3. Qualitative test can be done with > 2 samples.

Yes                      No

4. Significance of difference is decided by referring to statistical tables.

Yes                      No

5. Which tests are used to know 'How' and 'Why' foods are different? What are the methods used to give marks?

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### 6.6.2 Affective Test

This group of tests is used to get the reaction of the consumer for the food. It tests the users opinion of the product. Three common methods are acceptance, preference and degree of liking. These tests need careful planning and the objective of the test should be known. Question should be asked accordingly. Selection of people who do the tests should be correct, for example baby foods should be tested by mothers and traditional family food should be tested by all at home. Consumer attitude will also change and it is better to check the target population periodically. The number of samples in consumer tests should not be more than two. Consumer response study should never be less than 50 number and 100 will be best. The questionnaire should be as simple and focussed as possible and related to the objective. Consumer tests can be handled for the four types of problems given below:

#### Acceptance Test

Acceptance is the simplest decision making job for the consumers but only one sample should be tested in one session. They should be asked to concentrate on attribute like for example, overall quality or aroma of new variety of rice, etc Since consumers will relate it to other factors as price, it can be done only at a central location in a shopping complex, college campus, etc., A new product can be tested here. These tests can be done at home also for example, a

new masala mix for rice. Results are given as percentage of people accepting it.

### Preference Test

Preference test is another possibility in consumer tests. Not more than three samples should be tested at a time. This can be as 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> preference. It should be done by consumers who are familiar with the product. For example cola a type of drink, by college students and instant coffee by office staff.

### Hedonic Test

Hedonic test is a direct reference to personal like/dislike to a product. The test is done on 5 or 7 point scale of 'like very much' to 'dislike very much'. The actual users will have to test the food/beverage. New product for example, noodles, shakthi drink etc., can all be tested by this method. Here also a minimum of 100 responses will have to be collected. Figure 6.4 shows one sample of score card for children's food. Here results are as percentage liking it or not.

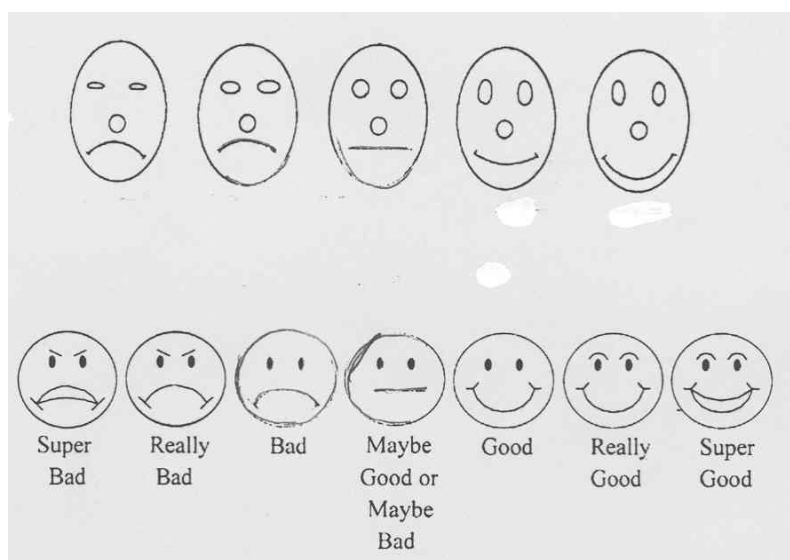


Figure 6.4: consumer evaluation card

### Check Your Progress Exercise 5

**Note:** a) Use the space below for your answer.  
b) Compare your answers with those given at the end of the unit.

1. How many people should do the consumer tests?

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2. In consumer tests three types are used, they are a) acceptance, b) preference, c) like. What is the opposite of these three?

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## 6.7 SENSORY TEST AND INSTRUMENTAL MEASURES

The sensory test when carried out by scientific method will be useful to support instrumental tests. The following are some corresponding tests.

### 6.7.1 Visual Examination

Visual examination is by the rods and cones in the eye where colour, shape, structure, freshness, etc. are observed. The human eye can distinguish up to 1500 different hues/shades of colour. For example, degree of colour in fruits from green to over ripe fruits, the shades of brownness in chocolates, etc. The instrumental measures for matching what the eye can see are in the visual range of 380–780 nm as  $L^*a^*b^*$  tristimulus values in CIE system. The average level of difference as seen by people can be used to describe the colour. Shapes of foods are easier to be measured in terms of geometry of height, length, etc. This can be shown as example in cakes that are baked, sweetmeats as jelabi, etc. Degree of freshness can be noticed in some products by checking for bubbliness, in some beverages as soda and orange.

### 6.7.2 Texture Examination

Auditory (hearing) sensation in foods is caused by stimulation of ear drum by the sound waves. This is called as texture as crispness of papads or fresh fruits as in apple, etc. It is what the teeth feel when biting the food. It is closely related to structure and movement of food in the mouth. There are advanced texture measuring instruments to study the hardness, softness of food and viscosity of beverages.

### 6.7.3 Olfactory – Sense of Smell

Olfactory or sense of smell is a chemical stimulation of the receptors in the nose and upper oral cavity. Human odour memory is short but can be trained to recall. Up to 150 odour types can be differentiated. The air carries the chemicals that give the smell. It is difficult to understand how nose can pickup differences in mango variety or bad smell due to toxins. Instrumental measures as gas chromatography or headspace volatiles are used to analyse the individual chemicals. Recently electronic nose is developed to match human response.

### 6.7.4 Gustatory – Sense of Taste

The sense of taste noticed by tongue and parts of oral cavity are developed early in human beings. Preference for sweet taste is seen even in one week old babies. Instruments for measuring salt content, sweetness and sourness are available. The simple ones are Brix (sugar content), sodium chloride content and pH (food acid content). Special methods are also there.

### 6.7.5 Flavour

Flavour is the common term for the total effect of odour, taste and touch experienced by people. It is a sensation more closely related to aroma when

the food/beverage is put in the mouth. Highly trained panel only can test this. No single instrument can measure this sense.

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### Check Your Progress Exercise 6



**Note:** a) Use the space below for your answer.  
b) Compare your answers with those given at the end of the unit.

1. Sensory tests for colour, shape and texture can be related to instruments.

Yes                      No

2. What causes smell in the nose and how do they reach the nose?

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3. No single instrument can measure total flavour test.

Yes                      No

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## 6.8 LET US SUM UP



In this unit we learnt that sensory analysis of foods and beverages refers to using humans as instruments/tools. The analytical tests for colour shape, aroma/odour, taste and texture of foods are done by trained people called panellists. Like/dislike, acceptance/rejection are tested by normal consumers is affective tests and done by consumers. Tests have to be carried out under bias free conditions i.e., without wrong influence. Specific methods of testing and analysing data is given by Indian Standards. There are three major types of analytical tests. We need not use any super taster but people like you and me can do the test. There are three types of consumer tests. For analytical tests seven to ten members are needed and for consumer test at least 50 people should be used. For all sensory tests, some instrumental analysis is possible but not for total flavour and acceptance or liking. Only human beings can tell this.

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## 6.9 KEY WORDS

<b>Senses of humans</b>	:	Eye for Colour and shape, teeth and flow in the mouth for texture and viscosity, nose and back of throat for smell and aroma of food. Tongue for taste.
<b>Analytical sensory Tests</b>	:	Tests done by trained people.
<b>Consumer tests</b>	:	Tests done casually in markets, schools etc.
<b>Sensitivity tests</b>	:	Threshold and two sample tests.
<b>Qualitative test</b>	:	More than two samples for arranging in order.
<b>Quantitative test</b>	:	Tests where marks are given.

<b>Iyendria</b>	:	Senses (analytical).
<b>Indria</b>	:	Likes/ dislikes (affective).
<b>Sensory analysis</b>	:	Iyendria Moulya Maapan.
<b>Bias</b>	:	Bad influence.



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## 6.10 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

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### Check Your Progress Exercise 1

1. b) Sensory quality test  
d) Affective quality test
2. Sensory analysis is a scientific discipline used to evoke, measure, analyse and interpret the reactions to food as perceived by sense of sight, taste, smell, touch and hearing. The sensory analyst will be equal to an analytical instrument.

### Check Your Progress Exercise 2

1. No
2. Yes
3. No
4. Analytical tests need more training of panellists as the judge has to perform like an instrument.

### Check Your Progress Exercise 3

1. Yes

Examples: Physiological bias- Fever, adaptation  
Psychological bias- Expectation error, cross talk

2. a) Wrong  
b) Wrong  
c) Right  
d) Right

### Check Your Progress Exercise 4

1. a) Threshold test  
b) Discrimination test
2. *Paired* and *Triangle* tests
3. Yes
4. Yes
5. Quantitative tests are used to get answers on how and why foods are different. The methods to get marks are, scoring, rating, scaling and time-intensity tests.

### Check Your Progress Exercise 5

1. At least 50 people should do the tests.

2. a) Rejection  
b) No preference  
c) Dislike

### **Check Your Progress Exercise 6**

1. Yes
2. Chemicals reaching the nose cause the sensation of smell. They are carried by the air we breathe in.
3. Yes

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## **6.11 SOME USEFUL BOOKS**

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1. Indian Standards (1968) IS 6273 parts I-III.
2. Shanthi Narasimhan and D. Rajalakshmi (1999), Sensory evaluation of fermented foods, in Biotechnology: Food Fermentation, Vol. 1, Ed. V.K. Joshi and Ashok Pandey: Educational Publishers and distributors, Asia Teca Publishers Inc. New Delhi, p.346-382.