

SENSORY EVALUATION

Basics of Sensory evaluation, Tools, Techniques, Methods and Interpretation

SENSORY EVALUATION

- **Sensory evaluation is a scientific discipline that analyses and measures human responses to the composition and nature of foods and drink.**
- **Sensory evaluation does not just deal with "likes and dislikes," "OK or not OK" but the process scientifically elicits, measures, analyses and interprets psychological and / or physiological responses to physical stimuli produced by a food product.**

SENSORY EVALUATION

DEFINITION

'A scientific discipline used to evoke, measure, analyze and interpret reactions to those characteristics of food and materials as they are perceived by senses of sight, smell, taste, touch and hearing.'

- **INSTITUTE OF FOOD TECHNOLOGISTS; USA**

HUMAN SENSES

- **‘Sense’ may be described as the physiological perception of a stimuli.**
- **There are 5 senses in human beings:**
 - **Sight : Ability of the eye and brain to detect electromagnetic waves within the visible range of light and interpret the image.**
 - **Hearing : Sense of sound. When vibrations propagating through a medium (e.g. air) are detected by the brain, sound is perceived.**
 - **Touch : Sense of pressure perception, mostly in the skin / tongue.**
 - **Taste**
 - **Smell**

HUMAN SENSES

- **TASTE / GUSTATION:** This is a "chemical" sense. The receptors (buds) in the tongue can distinguish 5 tastes:
 - Sweet
 - Salt
 - Sour
 - Bitter
 - Umami : a savoury and subtle taste that is associated with a soupy or brothy note. The receptors on the tongue identify the glutamic acid residues in the food.

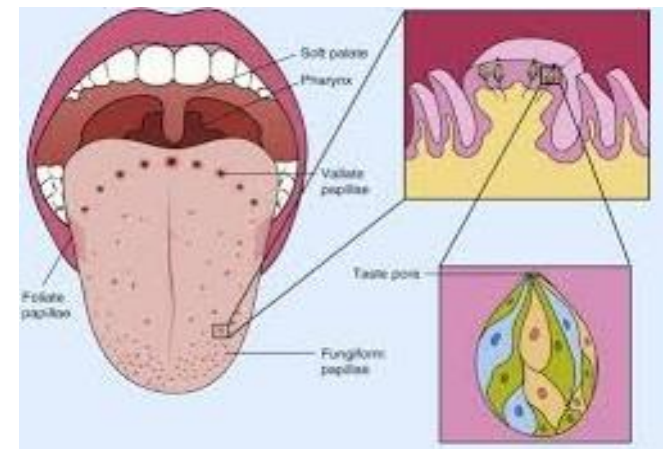
TASTE SYSTEM

- **The tongue is the main taste receptor.**
- **The structures that give the tongue its rough structure with raised protrusions on the surface are called papillae. Four types of papillae present in the human tongue:**
 - **Fungiform papillae**
 - **Fili form papillae**
 - **Foliate papillae**
 - **Circumvallate papillae**
- **Taste buds are located in all the papillae except for the Filiform papilla.**
- **Tongue contains approximately 10,000 taste buds.**

TASTE SYSTEM

TONGUE SURFACE WITH PAPILLAE

- Each taste bud has taste cells that extend into the taste pore.
- Every taste cell is associated with one or more nerve fibres.
- when chemicals from food contact the tips of taste cells, ion movement across the membrane of taste cells takes place to cause transduction.
- These signals reach the spinal cord through many pathways and then go to the Thalamus.
- The brain detects the taste of the food.



TASTE

Taste is expressed in terms of a food being

sweet

cool

bitter

umami

zesty

warm

hot

tangy

sour

sharp

rich

salty

bland

rancid

tart

acidic

strong

citrus

mild

savoury

spicy

metallic

weak

SMELL / ODOUR

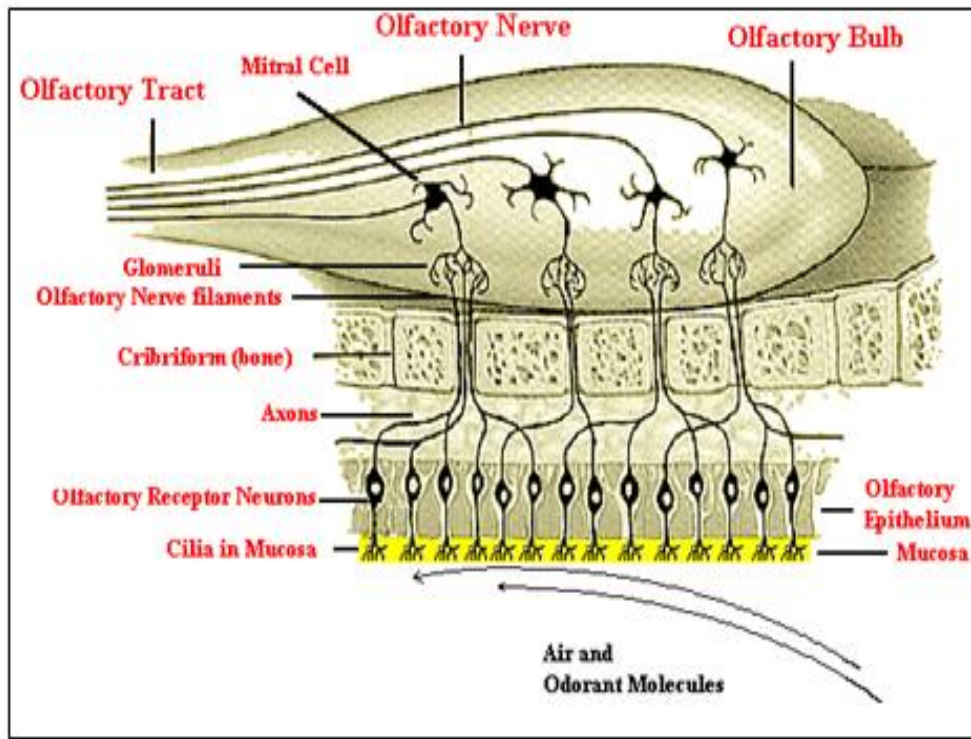
- The nose detects volatile aromas released from food. A specific odour may be described for a particular food, e.g. green, cheesy, nutty etc. The intensity can also be recorded.
- Odour and taste of a food together produce the flavour of a food. Due to this mechanism, people suffering from cold find it difficult to determine the flavours in foods.

- Usually **odours** are described as

aromatic	pungent	spicy	woody
floral	bland	green	citrus like
earthy	rancid	savoury	leathery
rotten	tart	oily	creamy
acid	strong	mild	buttery
musty	weak	scented	mossy
fragrant			

SCIENCE OF SMELL : OLFACTION

- **We humans are microsmatic : we do not possess a keen sense of smell as it is not crucial for our survival.**
- **Humans can discriminate among 100,000 odors but they cannot label them accurately.**
- **First, odor molecules from food bind to receptors in the nose.**
- **Signals from the receptors travel up to the olfactory bulb, a Q-tip-like structure roughly above the eyes.**
- **From there, some signals go to the primary olfactory cortex and on to the higher-order parts of the brain.**
- **But few signals from the olfactory bulb directly go to the amygdala in the brain, an area that is relevant to emotions and some go to the hippocampus, which is involved in memory.**
- **Hence, we sometimes associate few smells in our memory with a specific emotion.**



THE OLFACTORY SYSTEM

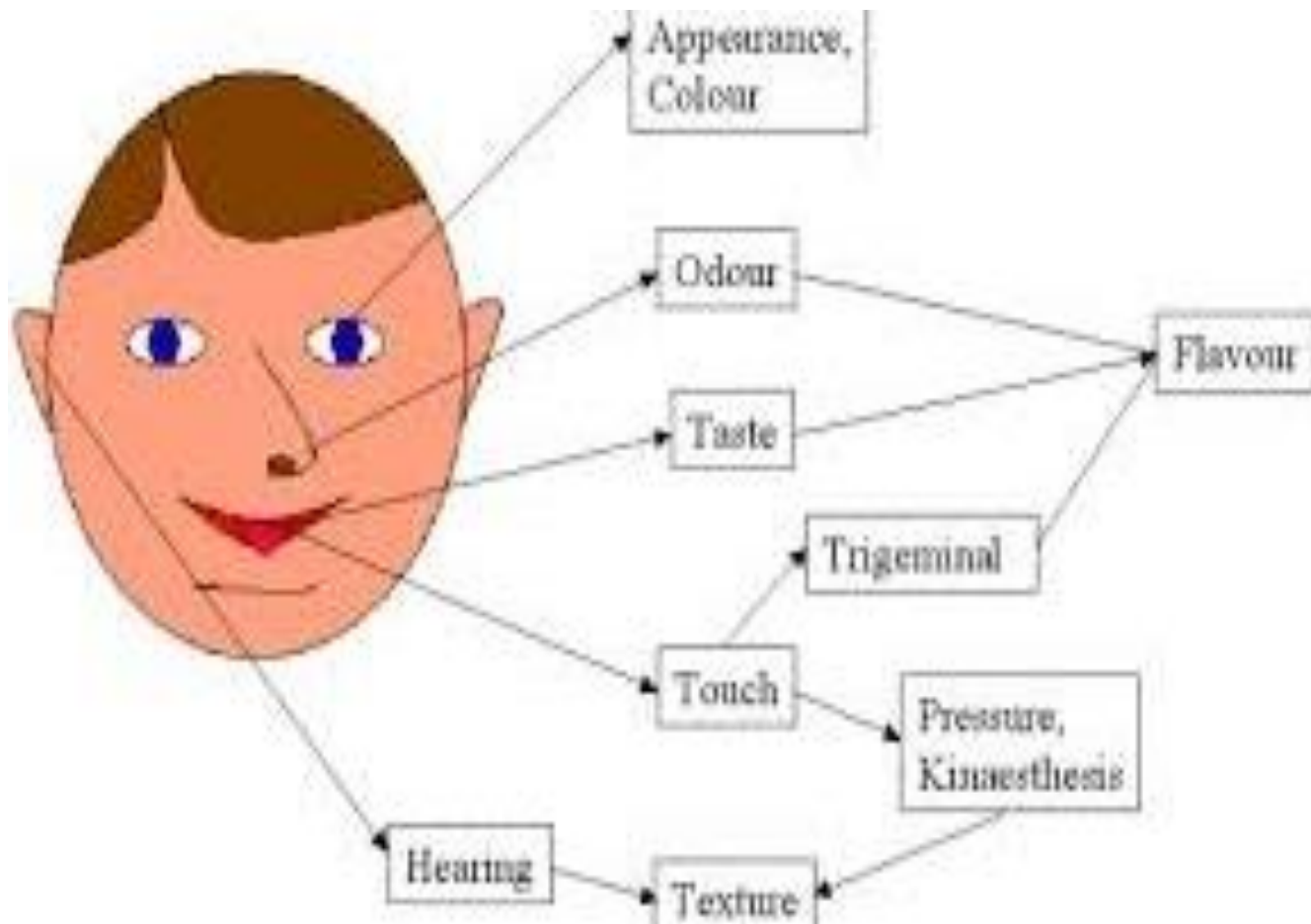
- Recognition of smell is immediate as the olfactory response is immediate, extending directly to the brain.
- This is the only place where our central nervous system is directly exposed to the environment

SENSORY PROCESS

- As all food products have a range of attributes and dimensions, the parameters usually studied in sensory evaluation are
 - Visual: package appearance, product appearance, color, shape size etc. Appearance plays an important part in helping to determine our first reaction to a food.
 - Tactile / Touch: Product feel, temperature, texture, softness etc. Texture is assessed through touch and physical contact with food. The resistance to chewing also affects texture, e.g. crunchy, chewiness.
 - Gustatory: Product taste. When food is placed in the mouth, the surface of the tongue and other sensitive skin reacts to the feel of the surface of the food and creates a mouth-feel of the food.

SENSORY PROCESS

- The mouth also senses the temperature of the food, which plays an important stimulus, e.g. cold ice cream, warm toast, hot soup etc.
- Olfactory: product Aroma and Flavour.
- Auditory: sound when consumed – crisp, crunchy etc.
- There are various methods to conduct sensory analysis of foods.
- Based on the test method, samples are prepared and panel members are chosen.
- The SENSORY PROCESS IS COMPLEX AND INVOLVES THE PERCEPTION OF ALL THE SENSES WHEN FOOD IS CONSUMED.



SENSORY PERCEPTION OF A FOOD SAMPLE

SENSORY EVALUATION : NEED

- **To detect the similarities /differences in a group of food products.**
- **To evaluate an existing food product against benchmark sample.**
- **To analyze food samples for further improvements based on market feed back.**
- **To elicit specific response to a food sample: whether acceptable or not by consumers.**
- **To study a particular property in an ingredient or a food product.**
- **To evaluate if a ready food product meets its original specification / standard sample.**
- **To obtain feedback data in order to make decisions and carry out suitable modification in a food product.**

SENSORY EVALUATION : USES

- **New Product development**
- **Before a new product promotion**
- **Determine the effect of formulation changes especially when availability of natural ingredients is scarce.**
- **Study the impact of processing changes.**
- **Ensure batch consistency.**
- **Monitor shelf-life changes.**
- **Determine consumer acceptance**
- **Expert versus consumer sensory report**
- **Sensory quality control and consumer loyalty**
- **Sensory evaluation in Food Science courses**

SENSORY EVALUATION : plan

- **Define the overall project objective**
- **Define the test objective.**
- **Screening the samples.**
- **Selection of the test method and panel.**
- **Conducting the test.**
- **Analyzing the data**
- **Reporting the results.**
- **Corrective action , if required.**

SENSORY EVALUATION : REQUIREMENT

- **Sophisticated Sensory booths as per ASTM standards with controlled temperature (20C – 22´C) and RH at 40±5%.**
- **Suitable Lighting in booths : White or Masked.**
- **Utensils / glass wares suitable for different foods.**
- **Laboratory for physical, chemical analysis of raw and prepared foods.**
- **Suitable area for preparation of food samples for evaluation.**
- **Suitable coding of samples : usually 3 digit coding is done.**
- **Appropriate method of sample presentation.**
- **Sensory panel members suitable for evaluation.**
- **Specialized software for statistical evaluation of sensory data.**

SENSORY ANALYSIS BOOTHS



SENSORY METHODS

DISCRIMINATIVE DESCRIPTIVE

- Product oriented – analytical & objective
 - Quality / quantity of a trait
 - Likeness / difference in samples
 - For Standardization purposes
- Few selected trained panel members

HEDONIC PREFERENCE

- People oriented – affective & subjective
 - Acceptance of a product
 - Initial impressions important
- Personal reactions / likes matter
- Usually more panel members eg. Samples tasted by people visiting a booth in a crowded mall.

SELECTION OF PANEL MEMBERS

- **American Society for Testing and Materials, Committee E-18 has given the guidelines for selection & training of sensory panel members.**
- **The selection of candidates should be based on specific personal attributes and potential capability in performing specific sensory tasks.**
- **Must be able to perform and repeat the task with consistent results.**
- **Panel members must be free from taste / odor perception disorders, color blindness, denture defects, frequent allergies not be consuming medications that affect sensory functions.**

SENSORY PANEL MEMBERS

- Panel members must have motivation, interest and responsible attitude towards sensory evaluation.**
- Panel members may be trained or randomly selected based on the type of evaluation required.**



SENSORY METHODS

- **Discriminatory tests**
 - **Simple Difference - “which sample is different?”**
 - **Triangle test**
 - **Duo-trio test**
 - **Directional Difference - “which sample is sweeter?”**
- **Paired comparison test**
- **Preference tests : Ranking test**
- **Scoring or Scaling - “how PUNGENT is the sample?”**
- **Sensitivity tests – If a mossy aroma is perceived?**

DISCRIMINATORY TESTS

- **Discriminatory tests are done to**
 - **determine whether the two samples are perceptibly different.**
 - **When 2 samples are chemically different and may be perceived as identical.**
 - **When there is a change in the processing method of a food product.**
- **Discriminatory tests are extremely useful for evaluation of a ‘new, improved ‘ version of an already existing product.**

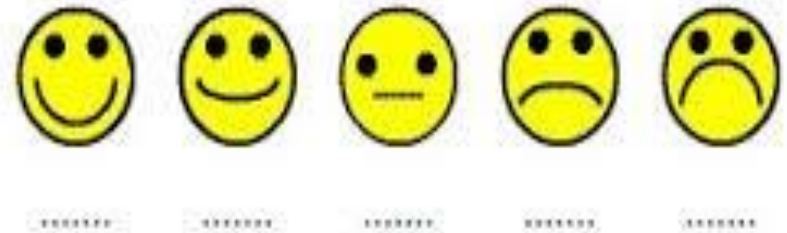
HEDONIC TEST

- **Very useful for measuring food acceptability.**
- **Uses a 9- point Hedonic scale ranging from ‘extremely dislike’ to ‘extremely like’.**
- **It is a people oriented test with large number of panel members, usually 50 and above.**
- **An extension of Hedonic scale with nine “child friendly” expressions ranging from “super good” to “super bad” is used with 5-10 year old children.**
- **A scale having “smiley” faces also elicits good response for food acceptability from children.**

HEDONIC SCALE

The 9-Point Hedonic Scale

- Like Extremely
- Like Very Much
- Like Moderately
- Like Slightly
- Neither Like nor Dislike
- Dislike Slightly
- Dislike Moderately
- Dislike Very Much
- Dislike Extremely

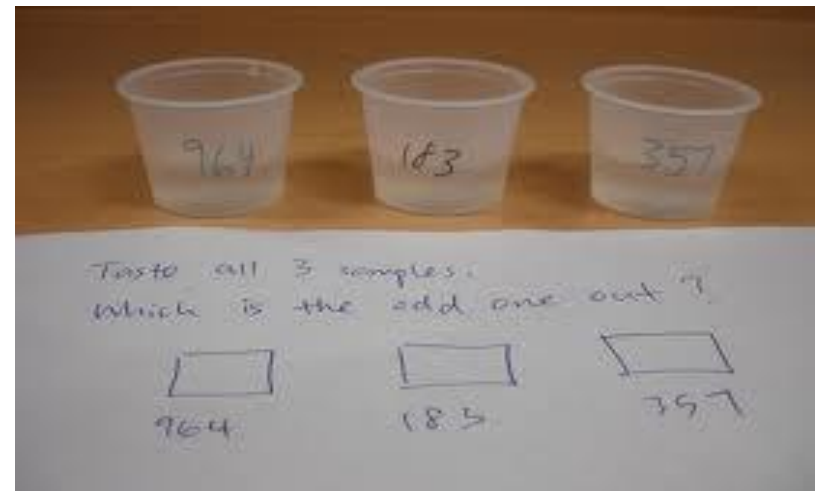


TRIANGLE TEST

- Panelist is presented with one different and two alike samples. If possible, all three samples should be presented to the panelist at once, and the panelist should be instructed to taste the samples from left to right. The six possible order combinations should be randomized across panelists. For samples A and B, the six possible order combinations are: AAB, ABA, BAA, BBA, BAB, and ABB. The panelist is instructed to identify the odd sample and record his answer

TRIANGLE TEST

1. You are given three coded 'JALJEERA' samples out of which two are identical and one is different. Please encircle the code of the sample found different. Thank you.



TRIANGLE TEST

2. Indicate the degree of difference between the “identical” and “different” samples:

- Very less -----
- Significant -----
- Much -----
- Very high -----

3. Please tick the acceptable sample:

- Identical samples -----
- Different sample -----

Remarks, if any:

Thank you.

Name: -----

Date -----

DUO – TRIO TEST

- **A Reference is provided with 2 coded samples.**
- **Is useful for products that have relatively intense taste, odor, and/or kinesthetic effects.**
- **A Duo-Trio Test determines whether or not a sensory difference exists between two samples. The degree / intensity of difference is not elicited . This method is particularly useful:**
 - **To determine whether product differences result from a change in ingredients, processing, packaging, or storage**
 - **To determine whether an overall difference exists, where no specific attributes can be identified as having been affected.**

DUO – TRIO TEST

- You are given one Control sample of 'Potato Soya gravy' labelled as 'R'. Along with that there are two coded test samples out of which one is identical with 'R' and the other is different. Tick the sample found different.*

- Sample code
619 _____

- 352 _____

- Comments:*

Thank you.

Name:

Date:



PAIRED COMPARISON TEST

- **The paired-comparison test (UNI EN ISO 5495) determines whether two products differ in a specified attribute, such as sweetness, crispness, redness, etc.**
- **Two differently coded samples are presented to each panelist simultaneously . (30 & more members)**
- **The panelist chooses the one that is perceived as more intense in the specified sensory attribute.**
- **The paired comparison implicates the “forced” choice and therefore the judges must give an answer in any case.**
- **The chance probability associated with this test is $1/2$.**
- **Frequently used in Preference tests.**

PAIRED COMPARISON TEST

“Mouth freshener with Dates.”

Start with the coded sample on your left. Tick the sample that is more chewy.

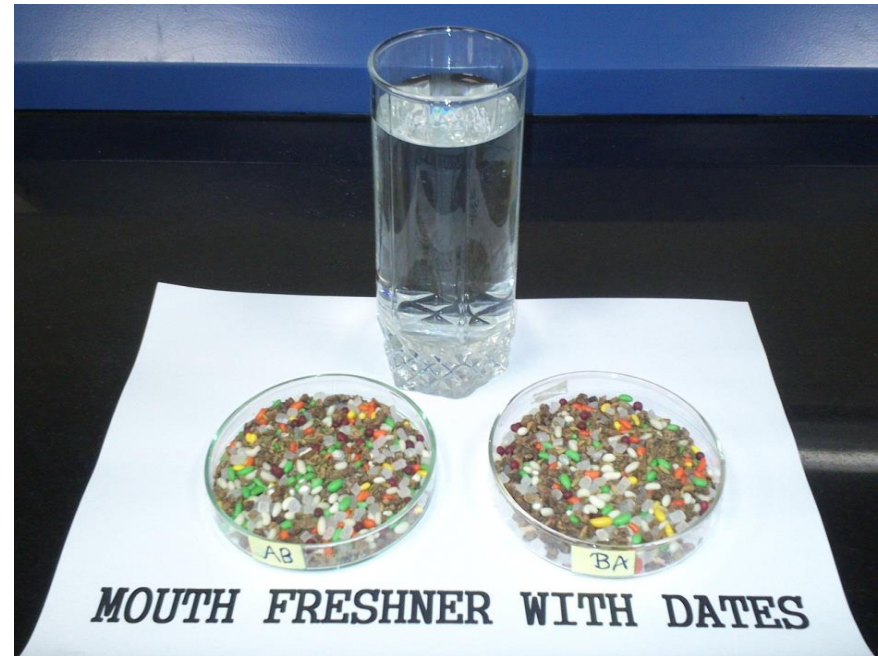
- AB -----
- BA -----

Comments:

Name:

Date:

Thank you.



INTERPRETATION OF RESULTS

- **By applying statistical techniques to the results it is possible to make inferences about the products under test.**
- **Most large FMCG companies have departments dedicated to sensory analysis and analysis of the results.**
- **Many software programs are available today for the analysis of data generated from sensory analysis.**
- **However, the statistical values will be meaningful only when the Sensory Evaluation is carried out in an appropriate method.**

SPICES : sensory evaluation....

- **Spices are indispensable food ingredients due to their unique flavour, colour and pungency.**
- **Spices possess several medicinal and pharmacological properties and are used in preparation of medicines.**
- **Volatile oils impart the unique aroma and oleoresins provide the taste of spices.**
- **The aroma compounds in spices that produce the flavourants used in the food industry are classified into functional groups like ethers, esters, thiols, ketones, aldehydes, amines, terpenes and other miscellaneous compounds.**

SENSORY PERCEPTION OF MIXED MASALAS

- **Mixed Masalas are complex mixtures of spices and spice blends available for use.**
- **Sensory evaluation of mixed masalas used is a combined function of appearance, odour, taste, flavour and texture.**
- **It is important to have an understanding of the individual profiles of the spices used in a mixed masala.**
- **Sensory analysis of Mixed masalas require a certain level of expertise to detect the proportions and fractions of various spices used in the preparation of the blend.**

SENSORY PERCEPTION OF MIXED MASALAS

- In Mixed Masalas, usually the perception of the presence of an individual spice depends on
 - ❑ the most volatile components and the ratios in which they occur in the blend.
 - ❑ The type or grade of a spice present; eg. Caryophyllene rich black pepper oils give sweet fruity note whereas a high pinene content in black pepper produces a turpentine like aroma.
 - ❑ The fraction of the spice extract used in the masala; eg. The characteristic flavour of ginger is perceived if the steam volatile oil components like monoterpenes, are present whereas the mouth feel and pungency is felt due to the presence of the non steam volatile components of ginger, called gingerols.

SENSORY PERCEPTION OF MIXED MASALAS

- ❑ The state of maturity of the spice at the time of use in a Masala Mix ; eg. A peculiar odour is observed when immature coriander seeds and its vegetative parts are used in a blend due to an aliphatic aldehyde in the coriander oil whereas a sweet and pleasant aroma comes from the ripe , mature coriander seeds due to the presence of a monoterpene alcohol called Linalool.**
- ❑The extent of the whole spice versus the extracts and other volatile components used for enhancement at the time of manufacture of the Mixed Masala will affect the sensory perception of the spice blend.**

CONCLUSION

- **Sensory evaluation of foods indeed is a very complex and specific science.**
- **It has to be remembered that no piece of laboratory equipment can match the ability of human senses of taste, smell, touch and sight to gauge the subtle differences in food flavors, taste, texture and appearance.**
- **It is recommended that Sensory evaluation always goes hand in hand with instrumental analysis in laboratories and Food manufacturing companies .**