Judging of Dairy Products

P. S. Prajapati
J. P. Prajapati

AgriMoon.Com
All About Agriculture...

JUDGING OF DAIRY PRODUCTS

Author

P. S. Prajapati & J. P. Prajapati

Department of Dairy Technology

AAU, Anand

INDEX

Module 1. Sensory evaluation, importance and terminology

Lesson-1

Introduction, Definition, Importance and Application of Sensory Evaluation in Relation to Consumer Acceptability and Economic Aspects

1.1 INTRODUCTION

The sensory quality of food products has been considered an important factor since the beginning of the food industrialization process due to its influence on the overall quality of the product. Quality, in terms of sensory properties, is related to the adequate levels of sensory attributes considering the appearance, aroma, flavor, and texture

Sensory analysis is used to characterize and measure sensory attributes of products. Sensory Analysis is the description and scientific measurement of the attributes of a product perceived by the senses: sight, sound, smell, taste and touch. By understanding sensory data, one can offer food-product development guidelines as to which property should be emphasized when making product-development decisions. This decision process includes processing ingredient and economic considerations. Not merely food "tasting" it can involve describing food color as well as texture, flavor, aftertaste, aroma, tactile response, and even auditory response. Sometimes ***sensory analysis*** is used interchangeably with ***sensory evaluation***.

Sensory analysis is a natural science. The measurements of sensory characteristics of foods should be taken carefully. When done properly, sensory information can provide great insight into the world. When measures are undertaken poorly, they do more to mislead than to inform. Careful controls must be implemented and followed when conducting sensory analysis, including (1) neutrality in the presentation of samples, (2) elimination of response bias, and (3) use of methods that require panelists to demonstrate their ability rather than relying upon self-reports. Failure to adhere to any of these controls diminishes the value of the resulting sensory data. By contrast, determining appropriate controls and ensuring they are in place will result in reliable and useful information about foods which no instrument can measure i.e. their eating quality.

1.2 DEFINITION

Sensory Evaluation has been defined as "A scientific discipline used to evoke, measure, analyse and interpret reactions to those properties of foods and materials as they are perceived by senses of sight, smell, taste, touch, and hearing." **Four** variables affect sensory evaluation: the food, the people and the testing environment and test methods used.

1.3 OBJECTIVES

Different components which form a foundation for an effective sensory evaluation programme are approved goals and objective, well defined programme strategy, professional staff, suitable test facilities and qualified test subject. The objectives of sensory evaluation are as under:

1. To study the sensory evaluation of dairy products for use of research
2. To provide useful and timely information and recommendation about sensory evaluation of the dairy products.
3. To develop methods and procedure relating sensory and analytical information for use in research, quality control and quality assurance.
4. To demonstrate the methods used for sensory evaluation of dairy products.
5. To describe correct procedures for sensory evaluation of dairy products.
6. To maintain awareness of new product development in product evaluation and their application.
7. To find out most cost effective and efficient method to obtain most sensory information.

1.4 IMPORTANCE

The role of sensory evaluation is to provide valid and reliable information to the research department, production and marketing in order for management to make sound business decisions about the perceived sensory properties of the product. Cost saving may be realized by correlating sensory properties with instrumental, physical or chemical analysis. Moreover, following points are equally important in sensory evaluation:

1 Man has well-developed like and dislikes for dairy products depending on their palatability.

2 Sensory evaluation will become paramount importance with increasing consumer awareness towards nutrition and quality.

3 Sensory evaluation assists in measuring the eating qualities of any food.

4 Optimal information can be obtained only through co-ordination of instrumental and sensory measurements.

5 Where no signal appears our senses may still perceive an odour or taste.

6. Senses give us a total impression of quality.

Sensory evaluation provides unique information that has significant importance/value in the market place. Successfulness of sensory programme will depend on the involvement of individuals, the sensory professionals and their ability to make meaningful contribution to the decision-making process.

1.5. APPLICATIONS

Sensory analysis gives answers to the following three questions

- What does the product taste like?
- What are its sensory characteristics?
- How does a change in production, packaging or storage affect sensory characteristics

Sensory evaluation can be applied in the following areas in dairy industry

- Companies can compare a competitor's product
- Improve products by modifying or changing the ingredients
- Check that the specification is being met
- Monitor quality control by checking regular samples against specification
- Detect differences between products from different runs or batches
- Profile the characteristics of new products

- Describe specific characteristics of the product
- Demonstrate new products to marketing team
- Promote new or reformulated products to consumers

Advantages

- Helps manufacturers, scientists, food technologists etc. to gain a clear perception of what ordinary consumers may experience
- Measures the overall impression of the product i.e. eating quality when consumed
- Sensory panel testing can be much more rapid than most non-sensory methods
- Uses more than one sense, making them more flexible instruments
- Can be very sensitive and good at detecting minute differences in product characteristics

Disadvantages

- Sensory panelists can become fatigued with the entire process of testing and assessing descriptive data
- Assessors may be subject to biases e.g. from loss of interest or from distractions
- To ensure precision in the analysis and interpretation of the descriptive data and for statistical analysis, several assessors may be required, making it an expensive proposition
- The entire process of recruiting and training sensory panelists can be a time-consuming and costly process
- It may not be easy to replace assessors quickly, as the incoming assessor will have to be given intensive training to develop requisite expertise of the job
- The sensory panel method can be more expensive than some non-sensory methods
- The panelists may not be good at quantifying perceptions
- Interpretation of results may get problematic and be open to dispute

1.6 SENSORY EVALUATION OF DAIRY PRODUCTS

One of the earliest users of sensory analysis was the dairy industry. Dairy product sensory evaluation includes the critical examination and interpretation of important sensory attributes of the given product. In the early 1900s, techniques for judging dairy products were developed to stimulate interest and educate people in dairy science. Three different methods are available for tracing causes of sensory defects in dairy foods: (1) chemical procedures; (2) microbiological tests; and (3) sensory evaluation. The simplest, most rapid and direct approach is sensory evaluation. A food technologist trained and experienced in flavor evaluation of dairy products has an ‘‘edge’’ over someone who is competent only in performing chemical and/or microbiological methods of product analysis. Correct diagnosis of the type and cause(s) of sensory defects is a prerequisite to application of remedial measures in production, processing and distribution stages. For dairy processors, the most important requirement of a comprehensive quality assurance program is careful and competent flavor evaluation of all dairy ingredients. Based upon sensory judgments, occasionally some milk, cream or other dairy ingredients may merit rejection. An important truism of the dairy industry is dairy products quality can be only as good as the raw materials from which they are made.

Judging and grading dairy products normally involve assigning quality scores to products by one or two trained “experts”. Attributes scored include appearance, flavor, and texture, based on the presence or absence of

predetermined defects. This approach has provided the dairy industry with a body of knowledge on sensory defects and their causes, and although these traditional methods are valuable for rapid product quality assessment in a hectic industrial setting, they are, in general, not useful for product innovation and development of new products that meet consumer acceptance.

Bureau of Indian Standards has specified guidelines for judging & grading of some dairy products. The sensory evaluation of dairy products has become an important research component in the development of new products and process.

1.7. SENSORY ATTRIBUTES OF FOOD PRODUCTS

Food products are developed, produced, and marketed to appeal to the consumer, who is becoming more and more demanding about quality. The perception of food quality is changing rapidly, which highlights the need for food producers to be innovative as a way to survive. In other words, the success of a product depends on its acceptance by consumers, because they are the ultimate users of the product and thus, the ones who will be willing to purchase the product. Therefore, professionals in various industries are eager to understand consumer perceptions and attitudes toward a new product, a formulation change, or a new process. If a product is not liked by consumers, the research or manufacturing project is considered to be a failure.

The sensory attributes of food products can be either intrinsic or extrinsic. Intrinsic attributes are concrete product characteristics that can be perceived by a consumer and, in many situations, can serve as a quality cue that can be observed, without actual consumption or use. It is related to the appearance, color, shape, size, and structure, all of them extremely important for milk products. Intrinsic attributes are always related to the physical aspects of the product. Extrinsic quality cues refer to product characteristics that are used to evaluate a product but are not physically part of it, such as price, brand, production and nutritional information packaging design, country of origin, store, and convenience (Table 1.1). Extrinsic cues become more important when products are very similar in appearance. The intrinsic and extrinsic cues are categorized and integrated by consumers to establish the quality attributes of a food product.

Table-1.1: Intrinsic and Extrinsic Sensory Attributes of Food Products

Intrinsic	**Extrinsic**
Appearance	Price
Color	Brand name and familiarity
Shape	Label (packaging design)
Size	Advertisement
Structure	Nutritional information
Aroma	Production information (environment, organic)
Taste	Origin (country)
	Store name Convenience

Module 1. Sensory evaluation, importance, application and terminology

Lesson 2. Factors affecting food acceptance and terminology related to sensory evaluation

2.0 FOOD ACCEPTANCE

2.1 INTRODUCTION

Acceptance of any Dairy/food products is based on, food attributes , sensory perception, personal attitudes and human physiology, , the manner of serving, decor, social grouping, cultural patterns, climatic conditions, consumer's psychology etc.

Food acceptance is regulated by :

1. Characteristics of the dairy/ food products: These include

-- Purity & Safety

-- Convenience

-- Functional Properties

-- Nutritional Value

2. Environmental surroundings

3. Established Food Habits

4. Intra organic Chemical conditions – may / may not related to metabolic process.

Food preference, food choice and food habits are important terms which have relationship with food acceptance. Food preference is particular food/s an individual likes or dislikes, food choice is foods selected by an individual at a given time whereas food habits are the sum of the food choices of an individual, constituting total diet. Because of awareness in knowledge of Nutrition Education, food habits are constantly changing. Food taboos of different types are widespread which greatly influence food habits.

2.2 FACTORS AFFECTING FOOD HABITS:

The major factors which affecting the Dairy/food products habits are:

1. Country Wise, Geography
2. Social Classes
3. Cultural patterns and religion
4. Groups of income and size of the Family
5. Occupational groups
6. Age groups, anxiety, food as gratification of love
7. Emotions on food habits (taboos)
8. Climate, specific environment – social psychology
9. Availability of Food
10. Method of preparation & serving

11. Media Promulgation – radio, paper, TV
12. Personal aspirations & identifications
13. Education
14. Racial & moral prejudices

Our senses particularly taste & smell, are intimately associated with food habits and have l influence upon food selection & food habits. The "eating quality " of a food includes all those sensations such as feel taste & smell, experience by the consumer when the product is taken in the mouth.

2.3. GENERAL TERMS RELATED TO SENSORY EVALUATION OF DAIRY PRODUCTS

Today Sensory analysis of foods is gaining importance all over the world as it provides information which helps in product improvement, quality maintenance, new product development and analysis of market. In sensory evaluation, words and concepts serve as units and means of communicating the results. The value of sensory test depends on terminology which are used to reproduce and communicate the results. Different terms used in sensory evaluation are described below

Absolute Judgment	A psychophysical method to estimate the absolute intensity of a stimulus or a categorical judgment based on an observer's experience. It does not include any external standard stimulus.
Acceptance	An experience or feature of experience characterized by a positive (approaching a pleasant) attitude or Actual utilization (Purchase, eating) may be measured by preference or liking for specific food item. Both are not the same although, the two definitions are often highly correlated.
Acuity	Ability to discern or perceive stimuli: sharpness or acuteness.
Adaptation	Loss of or change in sensitivity or response to a given stimulus as a result of continuous exposure to that stimulus or a similar one.
Adequate stimulus	Normal stimulus sufficient to elicit a response from a given sense.
Affective Response	Acceptance or avoidance responses. Hedonic scales measure affective responses, that is, degree of pleasantness.
After – Taste	The experience which, under certain conditions, follows the removal of a taste stimulus; it may be continuous with the primary experience or may follow as a different quality after a period, during which swallowing, saliva, dilution and other influences may have affected the stimulus substances. (a) After sensation, Negative After - image or after - taste in which the qualities are complements of those originally and normally induced by the stimulus. (b) After sensation, Positive After image or after taste in which the qualities are the same as those originally and normally induced by the stimulus.
Ageusia	It is a gustation abnormality which relates the lack or impairment of sensitivity to taste stimuli.

Anesthesia	It is an olfactory abnormality which relates temporary impairment of senses of smell and taste.
Anosmia	It is an olfactory abnormality which relates lack or impairment of sensitivity to odor stimuli. i.e. temporary/ permanent loss of smelling capacity.
Ante taste	A prior taste, or foretaste, usually of short duration, preceding the main taste or flavour characteristics.
Appearance	The visual properties of a dairy/food products, including size, shape, colour and conformation.
Appetite	Desire or inclination for anything, but more especially for food.
Aroma	Sum of olfactory impression derived from the volatile substances of a food product. Differs from odor in the respect that many of these substances are first released through chewing, warmth of the mouth, etc. and only then contribute to the sensation via the throat - nose - duct.
Attribute	Classification of individual units as acceptable or unacceptable.
Autosmia	It is a olfactory abnormality which relates the odor sensation in absence of odor stimuli.
Aversion	Dislike and avoidance of a of a stimulus; repugnance; antipathy
Body	The quality of a dairy/food products relating variously to their consistency, compactness of texture, fullness, or richness.
Chewy	Tending to remain in the mouth without readily breaking up. or dissolving. Requiring mastication.
Chroma	One of the three terms used in the Munsell notations to denote colour referring to the saturation, or purity dimension.
Comparative Judgment	Direct Evaluation of one stimulus with another relative to a specified dimension, such as intensity or degree of liking.
Compensation	The result of interaction of the components in a mixture of stimuli in which each component is perceived as less intense than it would be alone.
Composite Scoring	A method for evaluating quality of a product where specific quality characteristics of a product are rated separately. The rating scale is weighed for the individual quality characteristics in relation to the relative importance of the individual characteristics to the overall quality. Resulting scores are compounded for any one panelist to arrive at a composite score.
Conditioned Response	A response, which comes to be elicited by an originally neutral stimulus, as a result of previous learning.
Confidence Interval (Statistical)	A range of values, which has a given probability (usually 0.95 or 0.99) of including the true value of the quality attribute being rated.

Contrast	Juxtaposition of two different sensations which result in intensifying or emphasizing their contrary characteristics. It may be of two types (a) simultaneous or (b) successive.
Contrast Effect	A judgmental phenomenon which appears in evaluation of food samples of different preference levels or quality, where the presentation of one sample tends to make a following sample of the opposite quality rate either higher or lower than it would if they had been rated independently.
Cooling	A physical sensation in the mouth resulting from the presence of a cold liquid or solid. Also a result of chemical action (menthol) sensed by the skin.
Critical	Refers to a defect of most serious kind. In foods, it is usually reserved for defects which may cause the food to be injurious to health. Tolerance for critical defects is practically zero.
Dilution Index	Basically the method involves the determination of the identification threshold for the material under study. The dilution index is expressed in % dilution or as a ratio. The dilution of 1% mean that the material was just identifiable when made up in a 1% solution.
Discrimination	a) Perception of difference between two or more objects in respect to certain characteristics. b) A differential response to stimuli which differ quantitatively or qualitatively.
Disguising Potential	A testing method wherein various increments of a flavouring compound are added to a substance (usually distasteful) to mask or disguise its sensory properties.
Evaluation Card	Wording questions used on semantic, sociological and psychological aspects to obtain the information desired from the penal
Expert	Generally, an individual acknowledged to be experienced and skillful in a special practice in the food and beverage field, a specialist with special powers of discrimination sensitivity and perspicacity, who usually confines his diagnostic judgment to a specific product under specific conditions.
Fatigue	Condition of organs or organisms which have undergone excessive activity with resulting loss of power or capacity to respond to stimulation.
Flavour	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.
Flavouring	Any substance, such as an essence or extract, employed to give a particular flavour.

Flavour Memory	As used in descriptive sensory analysis, an ability to recognize and identify many individual odours and flavours.
Flavour Profile Technique	A method of qualitative descriptive analysis of aroma and flavour. The method makes it possible to indicate degree of difference between two samples on the basis of individual character notes, the degree of blending and the overall impression of the product.
Forced Judgment	A reaction required by an experiment in which "don't know", or other indeterminate answers are not permitted.
Fragrant	A pleasing olfactory quality, odours which are distinctly pleasant smelling.
Grading	Sorting of products according to size or quality.
Gust	A unit of gustatory intensity relating to the threshold of a given substance.
Gustation	The process of tasting.
Haptic	Pertaining to the skin or the sense of touch in its broadest sense.
Hedonic	Pertaining to pleasurable or unpleasurable experiences.
Inadequate Stimulus	When a reaction is obtained by the application of energy which is not 'normal' to the sense system involved (such as an electrical current applied to the tongue producing a taste), the non-normal stimulus is termed inadequate.
Intensity	A quantitative attribute of a sensation approximately proportional to the intensity of physical energy of the stimulus, such as brightness of colours, loudness of sounds, and concentration of taste or odour compounds.
Intensity Scale	Scaling method consisting of numbers of terms used to denote the strength of a medium.
Interaction	A measure of the extent to which the effect of changing the level of one factor depends on the level(s) of another or others.
Iso-hedonic	Equality in degree of pleasantness and unpleasantness.
Judge	Examiner with some experience and / or training regarding the test problem.
Just Noticeable Difference (JND)	The smallest detectable difference between two stimuli.
Kinesthetics	Referring to the sense of feel by means of the mouth or fingers.
Masking	In taste, odour, or flavour application, it is a component quality within a mixture which dominates or over - rides another quality or other quality present, thus changing the quality of the perceived resultant without benefit of chemical interaction of the components themselves.
Matching	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.

Merosmia	A condition analogous to colour blindness in which odour are not perceived.
MID	Minimum identifiable difference; difference threshold.
Mouthfeel	The original experience deriving from the sensations of the skin in the mouth during and / or after ingestion of a good or beverage. It relates to density, viscosity, surface tension and other physical properties of the material being sampled.
Multiple Comparison	An unlimited number (usually more than three) of samples are presented to the observer simultaneously in random arrangement or in accordance with a predetermined statistical design. Significance of result is usually calculated by the variance method, or a rapid approximation thereof.
Multiple Range Test	A test employing different significance values depending upon the number of means being compared.
Objective	a) Capable of being recorded by physical instruments or as a consequence of a repeatable operation. b) Not dependent upon the observations and reports of an individual, and thus verifiable by others.
Observer	One participating in a test, whose primary attention is directed towards judge's response.
Odorant	A substance which stimulates the olfactory receptors.
Odour	Impression derived by smelling or sniffing. Positive hedonic sensation (pleasing) is "fragrance". Negative hedonic sensation (offensive) is "stink".
Olfactometer	An instrument for controlled presentation of odour stimuli, used for measuring threshold and other quantitative values.
Olfactory Coefficient	The smallest volume of vapour of a substance necessary for identification of its odour.
Organoleptic	Of the intrinsic quality of food which has an effect on the senses.
Paired Preference	Paired comparison method using the preference criterion.
Palatable	Pleasing to the taste, and hence, acceptable.
Panel	A group of people (observers, subjects, judges) comprising a test population, which has been specially selected or have special knowledge or skills, or may merely be available and pre-designated. a) Close Panel When judges work in individual booths and communication between them is forbidden. b) Open Panel When judges sit and work in view of each other, even perhaps commenting aloud and comparing notes.
Preference	(a) Expression of higher degree of liking. (b) Choice of one object relative to other, (c) Psychological continuum of affectivity (pleasantness - unpleasantness)

	on which such choices are based. This continuum is also referred to as that of degree of liking or disliking.
Primary Qualities	Within a specific sense, those qualities which are considered basic and from which it is possible to compound all other qualities. For example, salt, sweet, bitter and sour are primary taste qualities.
Psychophysics	The study of the physical relations between stimulus variables and psychological measures of sensory variables.
Psychophysical Methods	A group of specific procedures used in psychophysical investigation.
Quality	(a) An aspect, attributes, characteristics, or fundamental dimension of experience, which involves variation in kind rather than in degree, (b) The composite of those characteristics that differentiate among individual units of a product and have significance in determining the degree of acceptability of that unit by the user, (c) An aesthetic standard for a product usually set by experienced users.
Rank order (Ranking)	A psychometric method that may be used in multiple comparisons where the subject considers all of the samples in a series at the same time and is required to rank them in order of some designated dimension; such as preference, intensity and quality.
Rating Scale	A method for securing and recording a judgment concerning the degree to which a stimulus material possesses a specific attribute, for example, by placing a mark at an appropriate position between the two extremes or a line that represents the possible range of degrees of the attribute.
Reaction	In the behavioral sciences, action in response to known or inferred stimulation.
Score	(a) Noun: A value assigned to specific response made to a test item (b) Verb: To rate the properties of a food on a scale or according to some numerically defined set of criteria.
Screening	Pre-testing of possible samples, techniques of judges.
Sensitivity	Acuity; ability to perceive quantitative and / or qualitative difference.
Sensory	Pertaining to the action of the sense organs.
Sequential Analysis	A procedure in which the sample number is not fixed in advance but depends to some extent on the outcome of the sampling as it proceeds.
Series effect	A tendency to over or underestimate a stimulus according to its magnitude in relation to the series as a whole.
Method of Single Stimulus	Any psychophysical or psychometric method in which a judgment follows the presentation of one stimulus only.
Smell	To perceive by excitation of the olfactory nerves.

Sniff	To evaluate an odor by drawing air audibly and abruptly through nose.
Sorting	A generic term for sensory tests that requires splitting of a number of coded samples into a specified number of designated subgroups: sorting involves both discrimination and matching and in some cases ranking.
Standard	A sample presented as a model or example. The standard sample conforms to a specified level or degree of quality.
Stimulus	That which excites a sense organ.
Subject	One participating in a test whose primary attention is directed towards the samples.
Subjective	Pertaining to individual experience.
Subliminal	Blow the threshold; applied to stimuli which are not sufficiently intense to arouse definite sensations but which, nevertheless, have some effect upon the responses of the individual.
Supraliminal	Above the threshold, either absolute threshold or difference threshold. See also subliminal.
Texture	Impression made by certain soluble substances in the mouth. Salty, sour, sweet and bitter are basic tastes (a) Taste Inhibitor Substance which renders taste organs less able to perceive delicate taste reactions, (b) Taste Sensitizer Substance which conditions the taste organs for keener perception.
Threshold	A statistically determined point on the stimulus scale at which occurs a transition in a series of sensations or judgments. Thresholds are of four kinds (a) Relative Threshold (RL) of sensation, stimulus threshold, or absolute threshold, is that magnitude of stimulus at which a transition occurs from no sensation to sensation, (b) The Difference Threshold (DL) is the least amount of change of a given stimulus necessary to produce a noticeable change in sensation, and the interval or units is known as JND (Just Noticeable Difference). (c) Recognition or identification threshold is that magnitude of stimulus necessary for correct identification, (d) Terminal threshold is that magnitude of a stimulus above which there is no increase in the perceived intensity of the appropriate quality for the stimulus.
Time - Intensity Test	Measurement of the rate duration and intensity of stimulation by a single stimulus.
Whiffing	A short, quick sniffing procedure.

Module 2. Requirement of sensory evaluation and physiology of human senses

Lesson 3. Design and requirements of sensory evaluation

3.1. INTRODUCTION

There are three major components for the successful implementation of sensory evaluation:
a.) Adequate sensory laboratory facilities
b.) Sensory panels and
c.) Rigorous training prograrmmes

3.2. SENSORY LABORATORY SET UP AND EQUIPMENT:

The physical setting must be designed so as to minimize the subject's biases, maximize their sensitizing, and eliminate variable which do not came from the product themselves. The test area should be centrally located, easy to reach and free of crowding and confusion, as well as comfortable, quite, temperature controlled and free from odour & noise.

The laboratory set up normally comprising of a reception cum briefing room, panel room and preparation room. Sensory evaluation should be carried out in quiet and well lighted room free from any odours. The dormant motive of constructional details should be to have comfort for concentrated prolong testing and ease of cleaning. Pleasing natural shades and maintenance of comfortable temperature and humidity conditions of the laboratory set up are desirable. The testing booths are located should be separated from sample preparation room and wash room and store by a complete partition. The panel test area should be readily accessible to all. A good location is one which most panel members pass on their way to lunch or morning break. If the panel of member are drawn from the outside, the area should be near the building entrance. Test room should be separated by suitable distance from congested are because & noise and the opportunity this would provide for unwanted socializing.

3.2.1 Reception and briefing room

It should be so designed as to ensure maintenance of pleasant attitudes and minimize traffic to the booths. Panel members shall assemble here, register, received the evaluation card and briefed about the test.

3.2.2 Panel booths

The booths may be arranged all side – by side, in an L – shape, or with two sets of three to four booths facing each other across the serving area. (Fig.3.1)The L – shape represents the most efficient use of the "work triangle" concept in kitchen design, resulting in a minimum of time and distance covered by technicians in serving samples. One unit of six to eight booths will accommodate a moderate test volume of 300 to 400 sittings per year of panels up to 18 to 24 members These booths should be located between or adjacent to the reception and preparation rooms, and should consist of test booths or identical design.

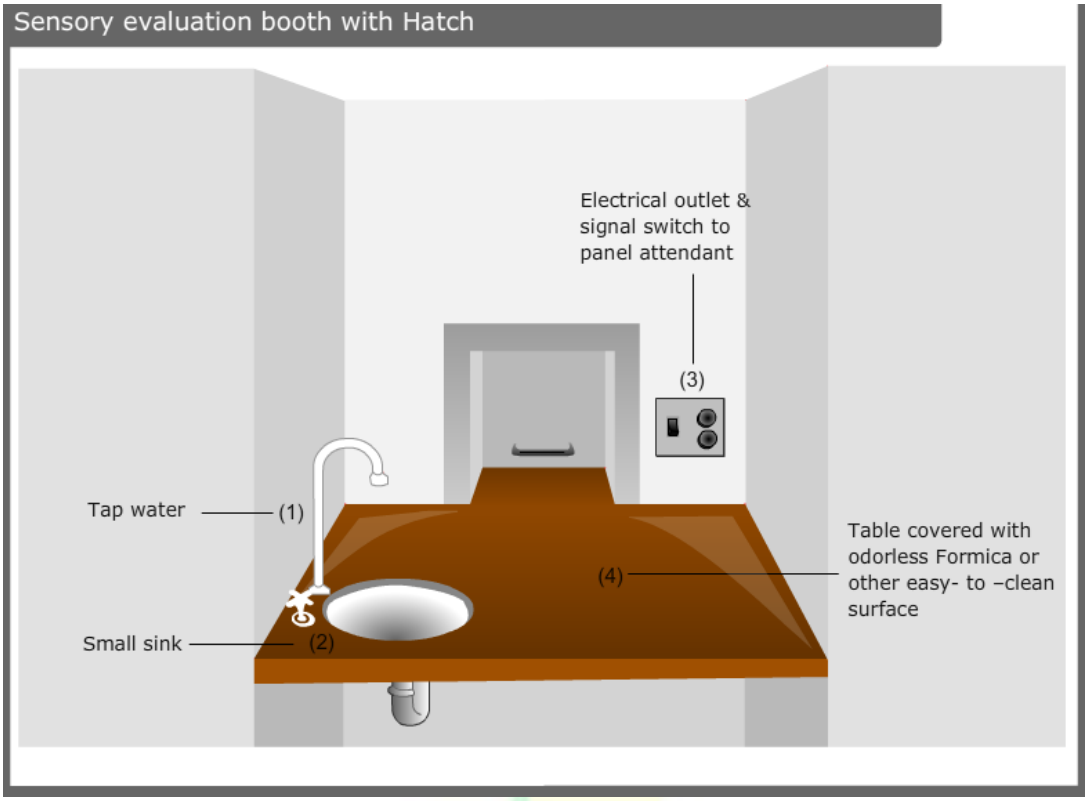

Fig.3.1 Differernt types of Sensory Evaluation Booths

Fig.3.2 shows a typical booth where in each booth may be 75 to 80 cm wide having adequate space to keep samples, drinking water, receptacle and writing space. It shall be separated by partitions to screen one person from the view of other when they are seated. Space can be allowed for installation of a PC monitor and a keyboard, if required. the dividers should extend approximately 18 in. above the countertop in order to reduce visual and auditory distraction between booths.. Revolving stool with back support or chairs should be provided with drinking water, cleansing towels and glasses and basins for convenient and non embracing expectoration's: The lighting of booths shall be uniform and glare free and arrangement should be made to provide white or coloured light.

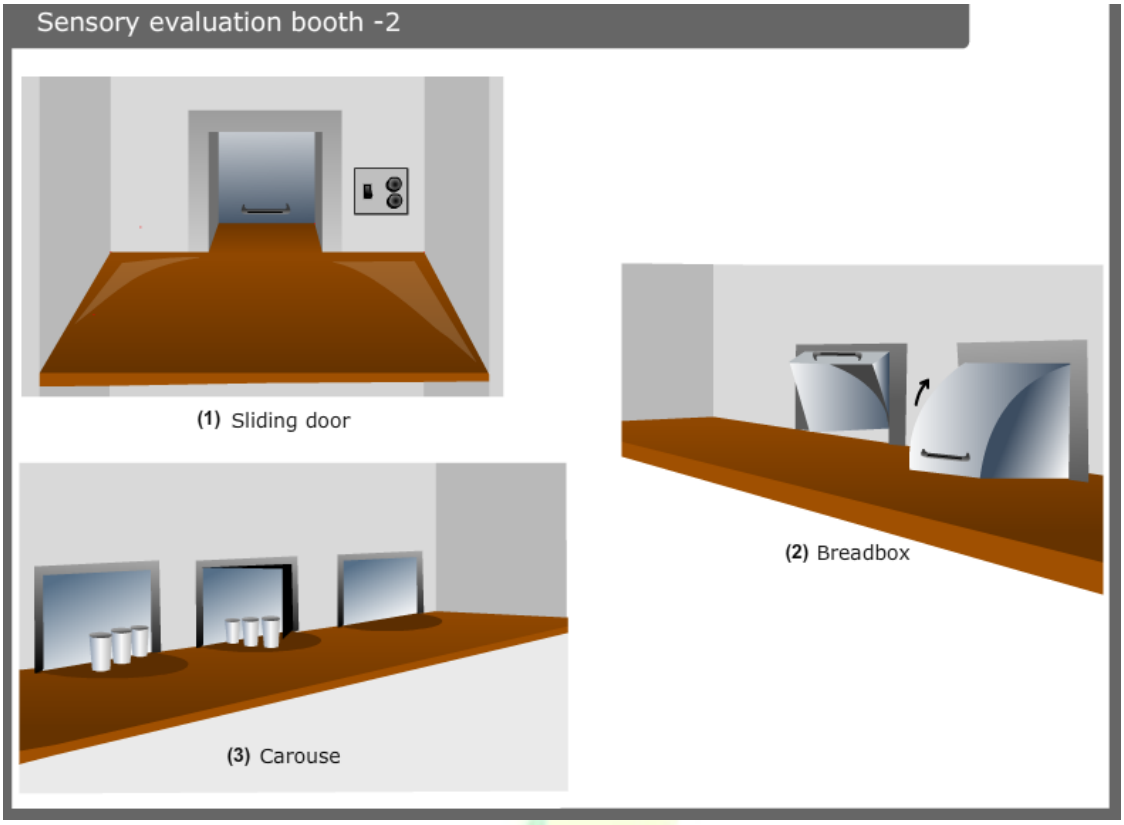

Fig.3.2 Typical booth

The lighting of booths (Figure 3.3) should be uniform and glare free and arrangement should be made to provide white or coloured light.

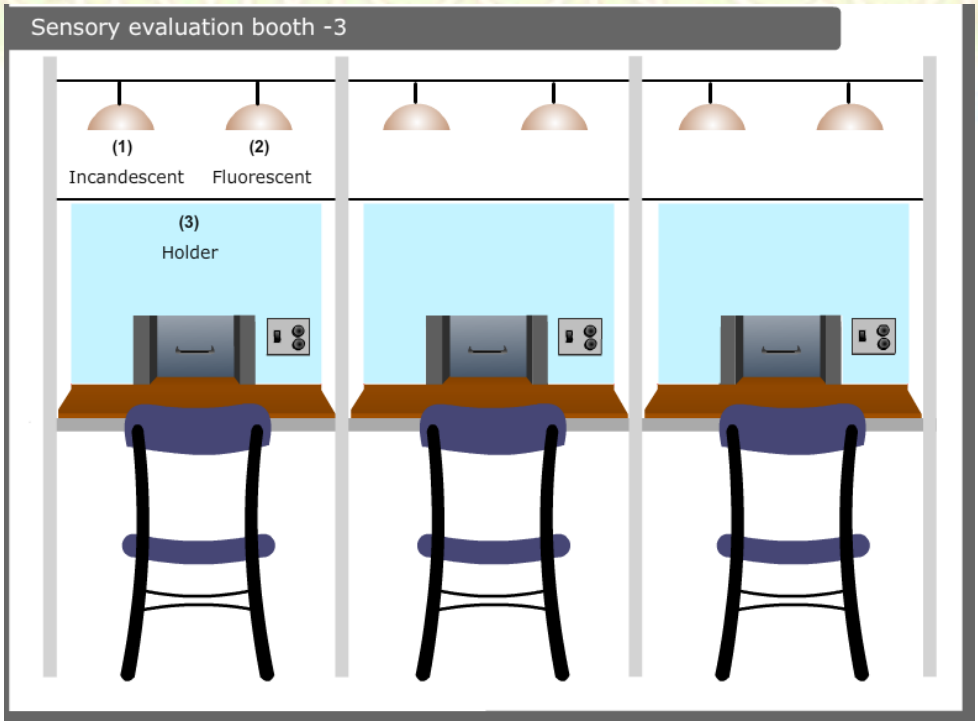

Fig. 3.3 Lighting arrangements for Panel booth

A temperature of about 20C and RH of 62% in the testing room in considered to be ideal. The entry and exit to the panel booth area by independent doors may be useful to avoid any communication between panel members.

Special booth features:

a.) A small stainless steel sink and a water faucet are usually included for rinsing. Filtered water may be required if odor – free tap water is unavailable.
b.) A signal system is sometimes included so that the panel supervisor knows when as assessor is ready for a sample or has a question. It may included an exterior light panel which indicates to incoming subjects those booths which are available.
c.) The materials of construction in the booths and surrounding area should be odor – free and easy to clean. Formica and stainless steel are the most common surface materials.
d.) Colour and lighting. The colour and lighting in the booths should be planned to permit adequate viewing of samples while minimizing distraction Walls should be off – white; the absence of hues of any color will prevent unwanted difference in appearance. Booths should have even, shadow – free illumination at 70 to 80 foot candles(fc) (typical of an office area.)

A common feature of many panel booths is a choice of red, green, and / or blue lighting at low intensity obtained through the use of colored bulbs or special filters. The lights are used to mask visual differences between samples in differences tests calling for the subject to determine by taste (or by feel, if appropriate) which samples are identical.

3.2.3. Special booth features

a). A small stainless steel sink and a water faucet are usually included for rinsing. Filtered water may be required if odour-free tap water is unavailable.
b). A signal system is sometimes included so that the panel supervisor knows when as assessor is ready for a sample or has a question. It may be included an exterior light panel which indicates to incoming subjects to those booths which are available.
c). The materials of construction in the booths and surrounding area should be odor-free and easy to clean. Formica and stainless steel are the most common surface materials.
d) The colour and lighting in the booths should be planned to permit adequate viewing of samples while minimizing distraction. Walls should be off- white; the absence of hues of any color will prevent unwanted difference in appearance among the samples. Booths should have even, shadow- free illumination at 70 to 80 foot candles (fc) (typical of an office area).

A common feature of many panel booths is a choice of red, green, and / or blue lighting at low intensity obtained through the use of coloured bulbs or special filters. The lights are used to mask visual differences between samples in differences tests calling for the subject to determine by taste (or by feel, if appropriate) which samples are identical.

3.2.4 Preparation room

It shall be suitably separated from the testing room and should be equipped for preparing and serving food samples. Typically, the preparation area includes immediate access to the following in addition to any specialized equipment dictated by the type of samples :

- A laboratory bench flush with the hatches so that samples trays will side through. The hatch on the service counter should preferably be constructed in such a manner that there shall be no recognition of individual or either side of partition.
- Benches, kitchen range, ovens, etc. for preparation
- Refrigerator and freezer for storage of samples
- Storage for glassware, dishes, glasses, trays, etc.
- Dishwashers, disposers, trash compactors, wastebaskets, sinks, etc.
- Frozen storage for panel member treats, if used

- Large garbage containers for quick disposal of used product, etc.

The laboratory facility should be flexible enough to handle current and future testing acitivities, as well as to provide a workable environment for the staff. The use of computers has been recommended for sensory evaluation work. In that case, sensory evaluation laboratory should include space for data processing equipment.

3.3. SAMPLING REQUIREMENTS / PREPARATIONS

a. Sampling should be carried out by a trained and experienced person and it is essential that the sample should be representative of the lot.

b. A procedure of sample preparation which is most likely to bring out the difference in the particular quality attribute under evaluation shall be selected. Care shall be taken that no loss of flavour occurs and no foreign tastes or odours are imported by the procedure during preparation, storage, serving etc. Depending upon the nature of the material and aim of the test, the need for a medium in testing auxiliary items should be decided. Foods like hot sauce, spices, vinegar, etc. may require dilution with some medium because of their intense physiological efforts.

c. The panelist should be allowed to have sufficient sample necessary to make judgement. Unless, only one sample is to be tested, full normal serving quantities shall not be served even through the material is available.

d. The temperature of serving should be close to that recommended for the food product. The samples shall be served in utensils of the same type and appropriate size, shape and colour and they shall not import any taste or odour to the sample. The test should be carried out at least one hour before or after lunch.

e. Use of materials which are likely to vitiate results, such as smoking, chewing pan (betel-vine) and taking intoxicants by a panelist should have a time lapse of at least half and hour before the test. Use of strong odoriferous substances such as cosmetics, flowers hair oil should be avoided.

f. The number of samples served in any one session shall depend upon the nature of the test product and upon the evaluation method used. In case the test product exert mild sensory effects, large number of the products exerting strong prolonged sensory effects, the number of samples may be reduced to less than 5.

g. Since coding is necessary to obscure the identity of the sample, a multiple digit code generated from a table of random numbers should be used. Avoid constant use of certain codes or a set of codes to expedite tabulation of results.

3.4. EVALUATION CARD

The evaluation card should be clearly printed and the matter should be arranged in logical sequence for examination which is expected under each test. Appropriate terminology without ambiguity shall be used. The evaluation card should be simple, brief, easy to follow and record what is exactly required. Due weightage should be given to all the sensory attributes.

*****☺*****

Module.2 Requirement of Sensory Evaluation and Physiology Of Human Senses

Lesson 4. Basic Principles: Senses and Sensory Perception

4.1 INTRODUCTION

The sensory properties of dairy products are mainly related to flavour, body and texture, colour and appearance. These properties of foods are perceived through human senses. The main senses involved in sensory perception are sight (eyes), smell (nose), taste (tongue), touch (skin) and sound (ear). Humans possess and utilize five primary senses for perceiving stimuli: sight, hearing, touch, taste and smell. Of these human senses, taste, smell and chemical/pain sense respond to chemical stimuli, with taste and smell considered to be the most primitive. Other human senses include temperature sensation (heat and cold), pain, visceral hunger, thirst, fatigue and balance.

4.2 ROLE OF VARIOUS SENCES IN JUDGING OF DAIRY PRODUCTS

4.2.1 SIGHT:

1. Neatness & cleanliness of package & finish,
2. Protection afforded by seal of pouch/bottle closures.
3. Relatively low numerical rating on the scorecard.
4. Attempt to correlate defects in visible items with flavour.
5. Caution: Sense of Smell & Taste -not unduly influenced by vision.

4.2.2 SMELL:

1. It has most important role in judging.
2. Greatly influence the quality of dairy products.
3. Odor & taste, combined with feel in the mouth, make up the concept "flavour".
4. Because of pleasing, satisfying and palatable flavor, dairy products are consumed - it has greatest numerical value on scorecards.

4.2.3 TASTE

1. Companion sense with smell in evaluating flavour.
2. Four fundamentals taste -Sweet, Sour, Salty and Bitter.
3. With few exceptions, the product must be tasted.
4. The role of taste is more complex, as above tasting it involves tactual & olfactory sensations.

4.2.4 TOUCH:

1. It plays a part in scoring of the dairy products.
2. Pressure between teeth determines the presence of undissolved salt or of crystallized lactose.
3. Fingertip and thumb may be used to substantiate findings of organs of mouth.
4. Fingers play important role in examining body and1exture of butter and cheese.
5. Ease and difficulty in chewing/rolling/dissolving the food is recorded by tongue, floor, roof of palate.

4.2.5 SOUND:

1. Used sometimes in the judging of the dairy products.
2. Relative size & distribution of the 'holes' in Swiss by gently tapping the outside of cheese

4.3 FUNDAMENTALS OF SENSORY PHYSIOLOGY

The sense organs consist of sensory cells which respond to stimuli and transmit an impulse via the nerves to the brain. The response of the sensory cells increases as the stimulus increases. A stimulus is any chemical or physical activator that causes a response in a receptor i.e. eye is a receptor for light.

4.3.1. Stimuli

An effective stimulus produces a sensation, the dimensions of which are
a. Intensity/ strength
b. Extent/ separation
c. Duration/ retention
d. Hedonics/ Like-dislike

4.3.2. Sensory receptors

These are the detectors that inform us of physical and chemical changes in our environment. Usually sensitive to single stimulus but may react to other stimuli. Eye, ear, skin, nose and tongue are organs. Each one of them has sensory receptor devices responding to particular range of environmental influences (stimuli) and transmits corresponding information to brain via the central nervous system. Specific sites in brain are stimulated by the sensory input. Upto certain extent, response of sensory cells is proportional to intensity of stimulus. Objectively, the response of the nerve is a function of the frequency of the electrical discharge of the nerve. Nearly all the receptors vary in their sensitivity to stimuli. Terms associated with sensory receptors are as follows

1. Modality: A group of similar sensory impressions, mediated by a given organ, is referred to as a "sense" more precisely "modality"
2. Quality: It refers to the further distinction of the sensory impression within each modality. E.g. sweet, sour etc. are taste qualities.
3. Stimuli: Factors from the environment that elicits sensory impressions/perceptions of a certain quality are called stimuli. It reacts with sensory receptors.

4.4. SENSORY IMPRESSION / SENSATION

It is an experience. The perceived odour "goaty", the "salty" taste, "gritty" mouthfeel, etc. would be the examples of sensory impression. Sensory impressions are very seldom received in partial/total isolation; a combination of such impression is called "sensation" (subjective).

4.5. THE CHAIN OF PERCEPTION

When sensory analyst study the relationship between a given physical stimulus and the subjects' response, the outcome is often regarded as a one step process. In fact there are at least three step process as shown in Figure 4.1. The stimulus hits the sense organ and is converted to a nerve signal which travels to brain. The brain then interprets the incoming sensation into perceptions. Finally the response is formulated based on the subjects ' perceptions.

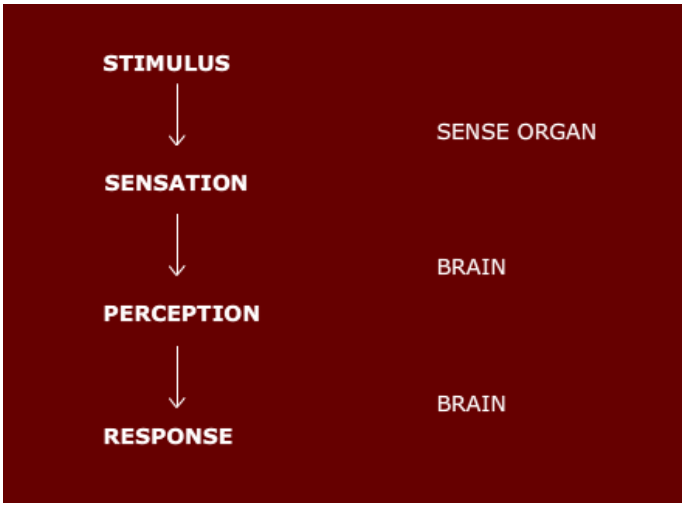

Fig. 4.1 Sequence of perception

A pure sensation is accompanied by an interpretation, with reference to experience of an individual, and the resultant overall impression is called "perception". We express a perception when we say, "This milk is too sweet" (subjective)

It has four basic dimensions: a) Time, b) Space, c) Quality, d) Intensity (quantity).

The senses are unifunctional in nature. For example, the sight is dependent on variations in radiant energy, touch and hearing to pressure changes and taste and smell to chemical changes. The various sensory reactions with corresponding stimuli, receptors and experience is given in the Table 4.1.

Table 4.1 Sensory reactions with corresponding stimuli and receptors

Sensory Modality	Type of Stimulus	Receptors	Experience
Distance Receptors			
Visual	Radiant energy 10^{-4} to 10^{-5} cm wavelength	Rods and cones of Retina	Hue Brightness
Auditory	Mechanical vibrations in frequency	Hair cells of organ of corti	Pitch, Loudness
Chemical Receptors			
Gustatory	Chemicals in solution	Taste buds	Taste
Olfactory	Chemicals in gaseous solution	Olfactory cells in upper nose	Odours
Somesthetic Receptors			
Cutaneous	Temperature changes	Cells in skin	Warmth, Cold
	Mechanical Pressure	Cells in skin	Contact (light pressure)
	Extreme energy of any class	Free Nerve endings	Pain
Kinesthetic	Mechanical Pressure	Cells in tendons muscles & Joints	Active movement weight, deep pressure
Vestibular (static)	Movement of head	Cells in semicircular canals and vestibules	Equilibrium
Organic	Chemical & mechanical action	Cells in viscera	Pressure, hunger, nausea

(Source: Amerine *et al.* (1965))

4.6. OBJECTIVE & SUBJECTIVE SENSORY PHYSIOLOGY

The response of nervous system to a stimulus is "objective". The analysis of sensation by the subject in the formation of statement is "subjective". The relationship between a stimulus and its perception by a 'sensory component' of the central nervous system can be principally described as a physical &/or chemical process within humans, but it is eventually manifested as a subjective statement. The area of natural science, dealing with subjective sensory physiology, is often termed as "Psychophysics". One of its major effort is to measure more effectively and accurately the variety & intensity of sensations.

Module 2. Requirement of Sensory Evaluation and Physiology of Human Senses

Lesson 5. Physiology of Sensory Organ-Tongue

5.0 PHYSIOLOGY OF SENSORY ORGAN-TONGUE:

Taste is defined as those sensations perceived in the mouth (almost exclusively on the tongue) which have to do sweetness, sourness, saltiness and bitterness. Taste stimuli are all soluble in water. Taste also includes esthetic appreciation.

Significance:

It commands interest of consumers helps in recognition, selection, acceptance, and pleasantness. Complete removal of taste buds result in dietary deficiency, contributes to the enjoyment of food. Taste is initiated by contact of an aqueous solution of a chemical with the taste buds on the surface of the tongue and the adjacent regions of the mouth & throat.

Dilute substances affect only the tongue. Stronger solutions elicit pain & sharpness in mouth.
The tongue facilitates by its muscular movements, which bring the taste materials into contact with the taste buds. The movement of tongue also constantly disturbs concentration gradients near the receptors and then tends to prevent adaptation to a given stimulus intensity. It helps in mastication, rolling food round in the mouth to ground and make acceptable to the stomach in addition to swallowing also. The anatomy of the tongue is shown in Fig.5.1

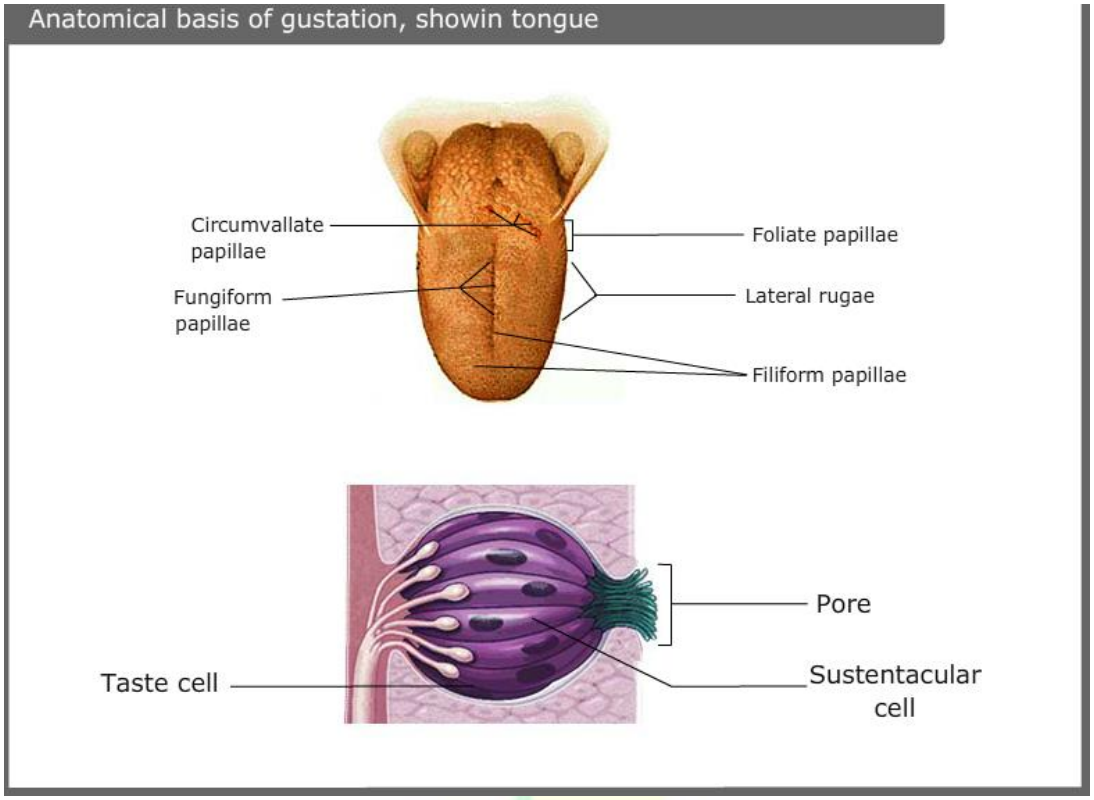

Fig.5.1 The anatomy of the tongue and taste bud with receptor cells

The length and weight of tongue is approximately 10 cm. and 56g, respectively. In general tongue is chiefly composed of striated muscle. The fibers of which are grouped into bundles that interlace with one another. They are disposed in three directions --longitudinal, traverse and vertical giving maximum mobility & physical control. The tongue is covered by mucous membrane. The dorsal surface of tongue is divided by circumvallate papillae into anterior 2/3 and posterior 1/3.

5.2 PAPILLAE:

The papillae are raised portion of the tongue, i.e. are the organs of taste. They are four different types of papillae which classified on the basis of shape.

1. Fungiform: Large, round, mushroom like in appearance, 0.8 -1.0 mm. in diameter, 1.0 -1.5 mm. high, greater in number at the tip and sides of the tongue, 150 -400 in no. It contains taste buds.
2. Filiform: Evenly distributed on the anterior 2/3, most numerous in number, but have no taste buds. It is keratinized structure, helps in movement of food. It contains endings specialized for tactile sense.
3. Foliate: Located on the posterior third of the tongue (in folds and on the sides). Not well developed in man and has little function.
4. Circumvallate: Form a V -shape on the back of the tongue, usually 6-15 in no., large 2 mm. high, 1.0 - 1.5 mm. deep, easily visible, contains taste buds.

Functions: --help in movement of food, contains endings specialized for touch (Filiform), give rise to taste sensations (Fungi, circumvallate).

With age , number. of papillae varies, becoming less in no., and more restricted in distribution.

The tongue is insensitive to taste in the regions, where there are no papillae.
Taste sensitivity is confined mainly to the tips & edges and absent in the middle of the tongue.

5.3 TASTE BUDS :

Taste buds are Organ detecting taste/ Taste receptors (Fig.5.2) Taste is sensed by the taste buds, which are located in the papillae on the tongue. The taste receptors are group of sensory epithelium cells. They have been identified and described as similar to flower bud, ever since the term " 'taste-bud' retained. Few buds exist in the mucosa of soft palate, in children on the sides and in the roof of the mouth. They do occur in the nose.

Fig.5.2 Taste bud with receptor cells

Taste bud in fungi form -occur on their upper surface. Taste bud in Foliate & Circumvallate -lie in their grooves.

Human taste buds located on moist surface within the oral cavity and pharynx that are lined with stratified epithelium. The number of taste buds per papillae varies from 33 to 508, averaging about 250. Each bud contains about 5 to 10 taste cells. Taste buds -also referred as taste onions -are spindle shaped cells bulging out at the root and coming together as the taste -pore -like petal of bud. Taste buds are 0.7-mm. long and 0.05 mm. wide at their widest diameter. With in the taste -bud are supporting cells & gustatory cells, arranged to enclose a chamber to give a bud - like structure. Taste bud looks like microscopic rosebuds. Their tasting action is a chemical process. Food must be liquefied before any real taste emerges. It binds to receptor cell of bud, a minute Electro-chemical current generated and passed by cranial nerves to gustatory terminals in the brain. The degree of the taste sensations depends on Solubility, Ionization (in case of acids & salt) and Temperature

5.4. THE ROLE OF SALIVA:

5.4.1 Saliva is mainly secreted by three-paired set of glands.

1. The parotid in the cheeks with a duct (thin & watery).
2. The Sub maxillary opens from the floor of the mouth (both).
3. The sublingual openings beside the membrane (thick & mucous).

5.4.2 Characteristics of saliva

Saliva varies in viscosity and amount.
Usually serous type, mainly secretion from parotid.
It contains about 99.5% water, 0.5% total solids (composed of salts, organic substances).
A modest amount of gases is also present in saliva.

The pH of saliva varies, but is usually slightly acidic (6.35 to 6.85).
After meals -pH rose sharply, but fell quickly to a slow lower point -just before meals.

5.4.3 Natural secretion of saliva is brought about by:

Stimulation of nerves in the mouth -food in the mouth.
By stimulation of sense organs other than taste.
Ingestion of fluids -stimulates mucous saliva.
Semi solid -thick, lubricating & diluting saliva.
Chewing, smoking, dry fruits, salt, acid etc. stimulates flow of saliva.
Fear, emotion -cause temperature suppression.

5.4.4 Functions:

1. Dissolve and dilute tasteful substance & carrying them to receptors.
2. Cleaning actions.
3. Moistening & lubrication actions.

4. Saliva also buffers acids.
5. Helps to control the temperature -relatively high specific heat.
6. High Potassium content -sensitizes to receptors.
7. High thiocyanate ion -shown to raise sweet threshold, decrease for bitter.

5.5. TASTE QUALITIES:

There are four basic taste -sweet, salt, sour and bitter. There is a regional distribution of the four types of the receptors to create area of sensitivity on the tongue as shown in Fig. 5.3

Fig.5.3. Regional distribution of the four basic tastes on tongue.

Some sensory authorities believe that there may be several other taste reactions, namely alkaline, metallic, watery and/or meaty. Feelings in the mouth such as common chemical/pain sense, warmth, coolness, astringency, smoothness, anesthesia and other feelings are not taste reactions, but are sensations of touch/pressure. The true basic tastes may be sensed with the nose obstructed.

5.6 RELATIVE INTENSITY :

5.6.1 It is the comparison of the taste intensity of the different tastes, by constructing ! psychological scales of taste intensity.

It is measured in the unit called "Gust"- the concentration of different tastes (relative strength) that matched I % sucrose was called "a Gust". Relative intensity of Sucrose: NaCI : Citric

Acid: Quinine hydrochloride is 1 : 14 : 220 : 2300.

5.6.2 Reaction Time:

The reaction time to taste i.e. "interval between initial stimulation of the receptor and the 1 report of reaction". It can also be defined as "the interval of time between the application oftne solution being tasted on the tongue and the appearance of the sensation.
In electro-physiological studies, the reaction time was estimated at 0.02 -0.06 sec.. whereas oral reaction time was estimated to be:
0.307 sec. for salt 0.536 sec. for sour
0.446 sec. for sweet 1.082 sec. for bitter

Thus, reaction time is not identical for all basic tastes. In comparison to other senses, tastes have the slowest reaction, hence, maximum reaction time.

5.6.3 Taste Sensitivity:

Taste sensitivity varies with individuals and with temperature. Salt & quinine Sulphate - threshold increases with temperature, that of HCI remains constant from 62.6 -107.6°F
for dulcin decreases from 17° -35 °C and rises slightly at 42°C. The concentration of a substance (in saliva) required to triggered the taste, is higher than the concentration (in air) required for odor.

Time is one factor, concentration is an another.

5.9 TASTE THEORIES

It was suggested that any theory of taste must account for the following:

1. the taste receptors respond rapidly to a chemical stimulus
2. all substances tasted must be in a liquid(soluble) form
3. a variety of substances stimulate taste receptors
4. the threshold concentration for stimulation are not large
5. many taste substances do not result in any rapid deterioration of the receptor cell i.e. nonphysiological
6. the taste receptors rapidly elicits a steady level of response with a magnitude that is a function of the concentration of the applied stimulus
7. the response to many substance remains constant over a long period of adaptation
8. receptor stimulation must be followed by electrical depolarization of end organ itself
9. a water rinse rapidly reduces the taste response
10. the receptors are the site of the chemical specificity
11. there are genetic variations in taste ability.

To this he added
-the response of NaCI between 20-30'C and pH of 3-11 is almost independent of temperature
-the presence if saliva is not necessary
-different species reveal different cationic series of taste receptor excitability

5.9.1 ENZYME THEORY:

It is proposed that enzyme activity near nerve fibers produces ionic changes, which induce the formation of nerve impulses. The taste substance would inhibit enzymes in some sites, leaving enzymes in other sites unaffected, thereby producing a change in the pattern of impulses reaching the brain. Thus, different tastes could be distinguished. This theory provides an explanation of why substances of widely differing chemical composition can have similar taste.

Limitation: the magnitude of taste response is independent of temperature, whereas enzyme reactions are very dependent on temperature.

5.8.2 BEIDLER'S THEORY:

According to this theory, taste sensation is dependent on:
-the particular types of chemo receptors that are activated
-the magnitude of their response
-the pattern of nerve discharge over each taste nerve fiber

He assumed that the gustatory reaction follows the mass action law and if the law applies the interaction of a stimulus with a given substance of the receptor is expressed by the expression:

$Kc = n/(s-n)$ -> eqn 1

where,

n = the total no. of ions/molecule that react with the receptors at concentration 'c' of applied stimulus.
s= the max no. of ions that can react
K = the equilibrium constant

If the magnitude of Response (R) is proportional to the no. of ions that have reacted, then

R= a*n where (a =constant)

For maximum response, Rm= a*s, substituting in eqn 1

Kc= R/(Rm-R) or C/R = C/Rrn + I/KRm

This equation relates magnitude of response to the concentration of the applied stimulus.

Note: C=I/K when R=Rm/2. If C/R is plotted against C, a straight line should result with slope = I/Rm and a Y intercept equal to I. This equation is similar to the adsorption isotherm

Longmuir, and similar equations have been used to express binding of ions by proteins. There is little reason to assume that there is only one type of stimulating mechanism for all types of taste substances. This is emphasized by the fact that sour and salty tastes are primarily elicited by electrolytes, whereas bitter and sweet tastes may be elicited by either.

5.9.3 ADSORPTION THEORY:

According to this theory, taste substances participate in an adsorption process, possibly with proteins, at the surface of the receptor. This results in a sapid depolarization of the receptor surface, which spreads to the attached nerve fiber and excites it. Adsorption results in a slight changes in the spatial configuration of there.

A leakage follows of some ionic species (probably potassium) from the interior, decreasing the normal potential across the receptor membrane. The spread of this local polarization over the rest of the cell surface may stimulate the innervating nerve, either by chemicals or electrical means, such that the frequency of nerve impulses generated is proportional to the magnitude of receptor depolarization.

Threshold concentration depends not only on the strength with which the stimulus is attached to the receptor site but also on the no. of sites available to the particular stimulus, for this reason, the effectiveness of the response may vary at low and high concentrations.

5.9.4 TASTE SPECTRUM THEORY:

It is believed that the so-called primary tastes are merely points of familiarity on a taste "spectrum". The determining factor in taste quality is thought to depend on:
-the stimulative effectiveness of the substance
-the penetration or adsorption of the compound by the receptors.

The receptors are differently susceptible to the penetration or adsorption. The taste spectrum concept does not exclude regional localization of end organs of quantitatively different susceptibility. As per him, there are two series of stimulatory substance: polar & non- polar. By this theory, a substance, which is both sweet and sour, would be difficult to explain.

TIME INTERVAL BETWEEN TASTING/ EFFECT OF AFTER TASTE:

After tastes do persists, some of the same quality as the preceding sensation and some quite different. Sweet compounds often have bitter aftertaste, and vice-versa. After tasting KCI solution or tasting Amla fruit or dilute HCI solution, then tasting water produces sweet sensation.

A pause (interval) ranging from 2-5 min. between each two stimuli has been suggested to allow the taste organs to return to normal taste conditions. It also helps in overcoming carryover of preceding taste,

5.10 TASTE INHIBITION AND MODIFICATION:

Substances have been discovered which have ability to change the perception of taste quality .

E.g. GYMNEMAGENIN able to suppress the sweet taste
MIRACLE FRUIT ~changes perception of sour to sweet

They have taste modifying proteins. TASTE SENSITIZERS:

They condition the taste organs for keener perception or render them to normal sensitivity over a prolonged period of tasting. E.g. salt, mild acids (1% NaCI solution for mouth rinsing/ fruits eaten between judging two samples of dairy products)

5.11 TASTE INHIBITORS:

They render taste organs less able to perceive delicate taste reactions. e.g. sugar, cream, cheese inhibitory effect on tasting, cause fatigue. All fail to stimulate flow of saliva.

5.12 ANESTHESIA:

Term used to designate temporary impairment of sense of taste e.g. ice cream. For this, it is necessary to expectorate ice cream in mouth to get it at body temperature, which helps to sense true taste.

*****☺*****

Module 2. Requirement of Sensory Evaluation and Physiology of Human Senses

Lesson 6. Physiology of Sensory Organ-Nouse

6.1. OLFACTORY

OLFACTION: The sense of smell nose is the organ of olfaction. Olfaction involves several distinct sensory systems located in nasal cavities. Smell is more primitive than vision, more complex than taste .

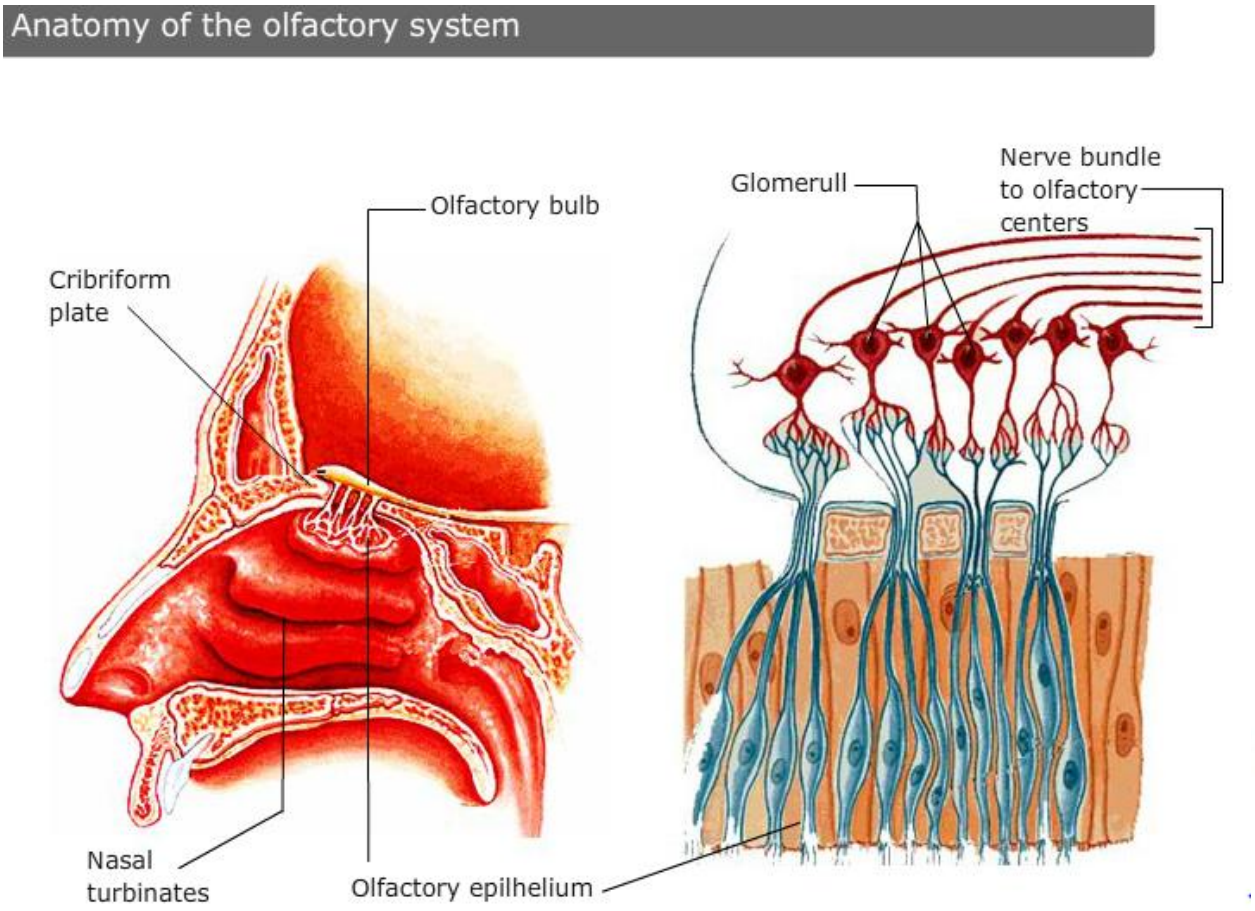

Fig.6.1 Anatomy of the Olfactory system

As shown in Fig.6,1, two nasal cavities are separated by a smooth median septum. The lateral walls of the cavities have a series of folds, approximately horizontal, varying from two to six. The lower fold extends over most of the length of the nasal cavity. The two above this called "conchae" are smaller protruded into the cavities to provide 3 channels the inferior, median and superior meatus. Each meatus is confluent with a large common meatus, which communicates with an olfactory cleft above the superior concha and the septum.

These spaces are all connected by very narrow passage with the posterior naris (chaoana) and with the pharynx. The upper & lower nasal passages are mere slits of 1-2mm. The deeper part of the nasal cavity contains a pseudo-stratified columnar epithelium containing ciliated cells, whose cilia beat toward the choana. The cavity also contains alvelo-tubular glands with mucifous cells. Air entering nasal cavity is warmed and humidified by passage -over the surfaces. The olfactory region or olfactory epithelium, is yellow-pigmented area about the size

of a postage stamp, located in the upper part of the nasal cavity and above turminate bones. Olfactory cells (10-20 million in man) through which odors are detected, are located in this area. Each olfactory cell terminates a number of hair like projections or extensions of the cell wall, called cilia, which extend into the mucous lining of the olfactory epithelium.

Nerve endings from the first cranial nerve called olfactory nerve, make contact with nerve fibers from the olfactory cells by way of "olfactory bulb" which is just above the odor- detecting area & separated from it by the perforated ciribriform plate. The nose is innervated with fibers from the fifth cranial nerve, which sense pain.

The simplified drawing of a section of the olfactory epithelium shows olfactory cells with their terminal hairs and nerve fibers, which serve the area. The overall physiological design for odor perception schematically outlined below.

6.2 IMPORTANT ASPECTS OF ODOR PERCEPTION ARE::

1. The prospective odor material must be volatile.
2. The odor-laden air must reach the olfactory receptors.
3. The differences in diffusion rates may be a factor in stimulation.
4. The odor must dissolve in aqueous mucus and then diffuse through it.

There is, of course, a critical concentration below which there will be no identifiable -sensation.

The exact definition of a threshold appears more difficult in this case than with other senses.

It is estimated that normal inspiration the fraction of inspired air passing the olfactory slit is at least 5% and at the most 10%, about 2% of the total odors molecules reach the olfactory epithelium in normal breathing.

Normally, most of the inhaled air follows past the olfactory area but does not impinge directly upon it, as chiefly eddy currents reach smell.

The odoriferous substance must be sniffed of whiffed rather slowly, but strongly while respiration is slowed, have stopped.

While exhalation there is no appreciate smell sensation.

However, in the act of swallowing, a slight vacuum is formed in the nasal cavity and as food starts down the esophagus, a small gust of odor-laden air from the food is drawn up in the olfactory area.

6.3 ODOR DETECTION/PERCEPTION:

The basic requirements are:

1. A substance must be volatile, and the molecules must make contact with receptors.
2. The volatility of a substance depends on its molecular weight and molecular bonding properties. The upper limit for "smell ability" is usually a molecular weight of about 300. Heavy molecular weight substance like proteins starches, fat and many sugars are too heavy to be odorous.
3. Molecular bonds vary with the chemical compounds and temperature.
4. Compounds that are more volatile are derived from liquids than from solids. Increase in temperature increases volatility of both states.
5. Odoriferous substances, must be adsorbed/adhered to the chemo-receptors, i.e. it should be soluble to some extent in the membrane constituents, which consists of lipids, proteins and water.

To perceive an odor, information is picked up as electrical impulses by the nerves to the brain, where message is decoded.

Man has capacity to distinguish/perceive odors. 3-4 yr. Children: rated many odors as pleasant, which they later considered unpleasant. Odor preferences are developed after the age of 5. Odorous material diffuses over 20 million receptors to trigger the olfactory reaction. The molecules/unit time, rather than total no. of molecules, appear to determine the character of odor. With training odors can be recognized at very low concentrations and several odors can be distinguished.

6.4. ADAPTATION:

Perception of a constant odor diminishes with the elapse of time is known as adaptation. It results in decline in sensitivity, increase in threshold. The rate of adaptation is a function of the stimulus intensity. As the adaptation occurs there may be a progressive change in the nature of odor. Fatigue for one odor may even raise the threshold for others.

6.5 ODOR STIMULI:

Odor is the property of a substance/s that is perceived in the human and higher vertebrates, by inhalation in the nasal or oral cavity, that makes an impression upon the olfactory area of the body, & that during and as a result of such inhalation , it does not cause or result in choking, irritation, cooling, warmth, drying, wetting or other functions foreign to the olfactory area. Impure odors are defined as those in which other senses in addition t the olfactory are excited.

Smell is not only a part of the esthetic pleasure in foods but it also has a protective mechanism. Spoiled foods often have typical and easily recognizable odors, which cause man to reject them. Fresh Fruits-vegetables-most attractive feature-odor/aroma Add herbs/species-to produce special desirable smells. Standards for odor in food-not universal Decomposed fish-enjoyed by.millions, 'ripe cheese' not appreciated by many people, 'curry' smell must be a cultivated taste.

Volatility or vapor pressure is not proportional to its odor. Musk-low volatility but powerful odorant, " Water-high vapor pressure but is odorless.

Low carbon alcohol (methyl & ethyl alcohol are particularly insoluble in fats and have very milk odors while the C4 to C6 alcohol are water and fat soluble and are having strongly odors. However, ethyl alcohol [C6], though lipid soluble is water insoluble and has no odor.

Organic compounds generally elicit odors, but the relation of composition to odor is extremely variable. Compounds of very different chemical composition may have quite similar odors while compounds of similar composition may be different in odor.

In concentrated solutions, many compounds have an unpleasant or repugnant odor but in dilute solutions, the odor may be very pleasant. E.g.H2S

6.6 THEORIES OF OLFACTION:

Approximately 50 different theories have evolved in the last century. Four theories are noteworthy due to their relative longevity of existence and / or supporting evidences.

1. AMOORE'S STEREOCHEMICAL TIHEORY:

The theory proposes that olfactory receptors are sensitive to the size, shape and the electronic status of the odorant molecule. Based somewhat on the lock an essential concept of enzymology, it was expressed that all odor sensations are based on a combination of limited number of primary odors and specific nerve receptors site cavities.

The internal dimensions and / or electrical of each nerve cavity were complementary to the molecular morphology of the primary odorant.

This theory is based on nerve impulse electrical conduction. It has been reported that nerve fiber (axon) membranes were composed of a lipid double layer with adsorbed protein on the inner and outer surfaces of axon. In the resting state, there was an excess of sodium and chloride ion on the outer surface and an excess of potassium ions on the inner surface of the axon.

Davies suggested that the relatively bulky, awkward and rather rigid molecules of the odorant (upon contact of axon) tended to penetrate and disorient the double layer of lipid, if only temporarily. This in turn resulted in holes in the axon surface, which permitted ionic changes to occur, and thus initiated a nerve impulse to the brain (odor perception).

2. WRIGHT'S VIBRATIONAL THEORY:

It has been suggested that the odor stimulus be conveyed at long range from the source to the nose or antenna by propagated electromagnetic radiation, as by ultraviolet or more likely infrared lengths. This was further modified by Wright, suggesting that the odors of the given chemicals are a function of their 'intrinsic molecular vibration frequencies, within the far infrared region of the electromagnetic spectrum (100-700 cm-I).

3. BEET'S PROFILE-FUNCTIONAL GROUP THEORY:

Beets stated that two molecular attributes were important in determining the characteristic odor: 1] the form and bulk of the molecule and the nature and disposition of the functional groups of the molecule.

Thus, theories of olfaction can be listed as follows:

1. VIBRATIONAL THEORY: based on correlation between infrared or raman spectra and odor quality.
2. MOLECULAR SIZE THEORY: based on the ability of specific odoriferous molecules to fit or fill a corresponding receptor sites.
3. MOLECULAR SHAPE'THEORY: based on the degree of fit into postulated receptor sites.
4. MOLECULAR INTERACTION THEORIES: dependent upon vapor pressure, solubility and other bulk characteristics of the volatile compounds.

6.7 OLFACTORY ABNORMALITIES:

1. Cryptosmia : obstruction in nasal passages.
2. Anosmia: temporary / permanent loss of smelling capacity.
3. Hemianosmia or Hyperosmia : excessive response.
4. Merosmia: loss of only certain odors.
5. Heterosmia / Parosmia : false odor perceived
6. Autosmia : odor sensation in absence of odor stimuli
7. Cacosmia : persistent perception of unpleasant odors.

Anosmia may be due to mechanical or central injury, or it may be functional. It has been reported that some individuals subject to migraine headaches had hyperosmia and that individuals with anosmia usually have defective taste sensitivity.

6.8 ODOR INTENSITIES:

The ratio of the olfactory threshold determined after sifting undiluted substance to the threshold determined after sniffing the diluents is termed as the order intensity. The threshold found after smelling the undiluted substance were much higher than those obtained after some structural isomers differed odor intensity measured thus

increases as the concentration of the undiluted substances in increase, but not after a certain point. Roughly odor intensity is proportional to the square root of the concentration of the solution.

*****☺*****

Module.2 Requirement of Sensory Evaluation and Physiology of Human Senses

Lesson 7. Physiology of Sensory Organ Ear and Eye

7.1. SENSE OF AUDITION

Sound is important in sensory evaluation of products. Crunching of nuts - an important quality attribute. However, it distracts attention from flavor – taste and smell thereby increases threshold. E.g. potato chips – crunchiness used for the advertisement. Sounds, are associated with food preparation e.g. popping of cream, perking of coffee, simmering, frying, cracking etc.

7.2 ANATOMY OF EAR :

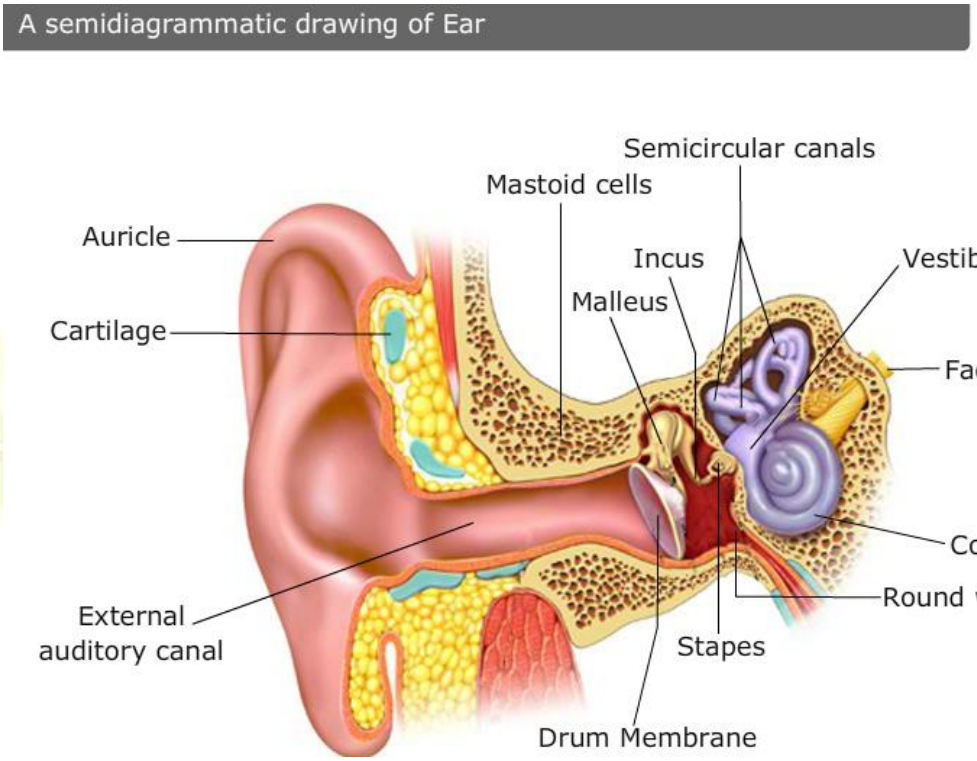

Fig.7.1 Semi diagrammatic Drawing of ear

1. The outer ear : The outer ear is comprising of flap of tissue, on the side of head, is a sound gathering trumpet. From it a 3 cm long canal runs obliquely to the eardrum, twisting to protect delicate inner components and warming air to keep things cozy. In this canal, a profusion of hairs and 4000 wax glands against infection, particularly when we swim in dirty water. The eardrum is tough tightly stretched membrane of less than 2 cm actross From there, intricate business of hearing starts. To it sound bearing airwaves strike like a stick – beating drum.
2. The middle ear: There are 3 tiny bones called the anvil, hammer and stir up in middle air. These 3 bones step up the tiny movement of eardrum, amplify them 22 times and pass them to inner ear via oval window attached to the last bone.
3. The inner ear: It is the real organ of hearing It resides in a fortress like the one caxern hollowed out of the body's hardest bone filled with watery fluid. Its Major hearing component is snail shaped cochlea,

whose twisting interior is joined / covered studded with thousands of microscopic hair like nerve cells, each one is tuned to a particular vibration. When the middle ear's stirrup "knocks" on the oval window leading to the inner ear, this fluid is set vibrating, and produces a current in nerve cells. The waving produces a wisp of electricity that feeds in to auditory nerve, which in turn leads to the brain.

7.2 SENSE OF VISION

The first impression of food is usually visual, and a major part of our willingness to accept a food depends on its appearance. Appearance is a compound of all the information of the size, shape and color and characteristics such as transparency, opaqueness, turbidity, dullness and gloss etc. mediated by the organ of sight / vision. Color prejudices do exist and often have a real basis:

1. Green colored fruits are usually unripe, while yellow or red is associated with ripeness.
2. The proper color is often one of the most important or only quality factor which consumers recognize.
3. In some cases, color changes are accompanied by undesirable changes in texture, taste or odor.

7.2.1 ANATOMY OF EYE:

Eye is just like a miniature television camera, and is much more sensitive than the biggest, costliest TV camera (Fig.7.2)

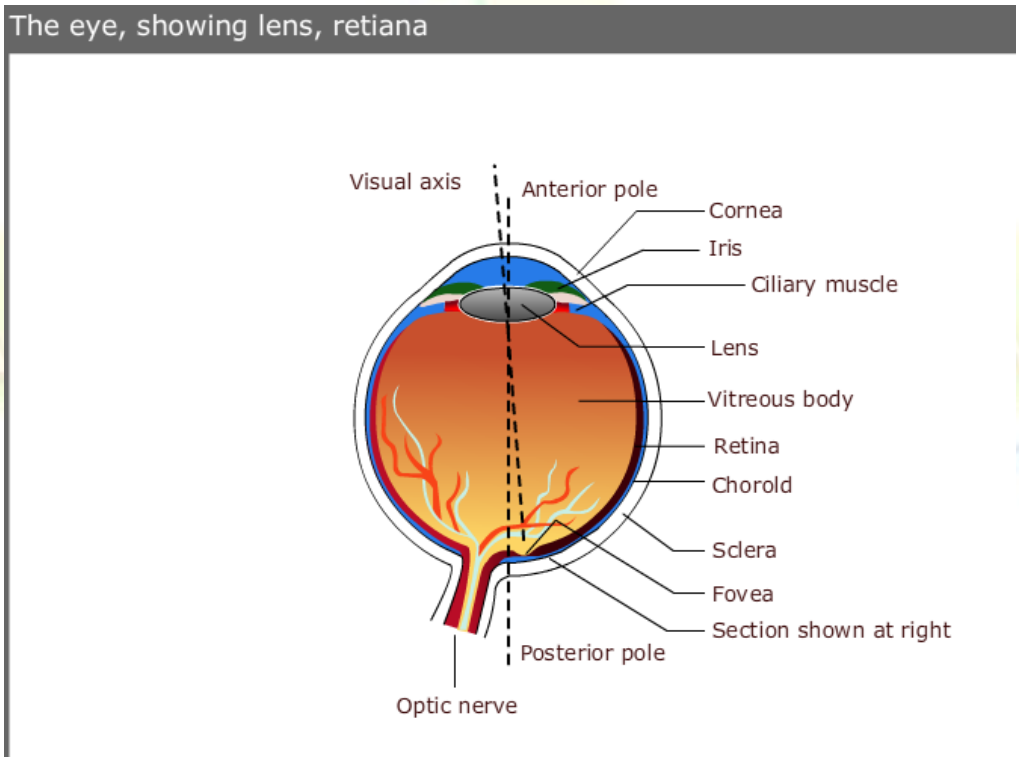

Fig.7.2 Anatomy of eye

7.2 .2 PARTS OF EYE :

1. Cornea : clear, dime-size front window, which bends light rays into orderly patterns.
2. Lens : A little envelope of fluid, the size & shape of an oval vitamin pill. A ring of tiny, strong, hard working muscle surrounds lens. These muscles when tense- lens flattens for near vision, when relax – it flattens for distant vision. There are two fluid-filed chambers in both the fluids must be clear to permit passage of light.
3. Pupil : An adjustable gateway for light. In bright sun it is nearly closed, on a dark night it is wide open.

4. Retina : A kind of onion skin wallpaper, which covers the rear 2/3 of my interior, Light passes through lens and brings it into correct focus on the retina covering less than 3 sq. cm, retina contains 137 million light sensitive receptor cells (130 million rod shaped for black and white vision and, 7 million cone shape for color vision)

Rods are scattered all over the retina. They contain a purplish-red pigment-rhodopsin. The faint light bleaches ' rhodopsin', and generates a tiny wisp of electricity, which is fed to straw size optic nerve and is transmitted to brain. Brain intercepts the signals flooding in and hand down its verdict. All this intricate electrochemical activity has been completed in about 0.002sec.

Cones are concentrated in the fovea-a pinhead size, yellowish depression at the rear chamber. This is the center for acute vision for reading, close work and for colors. Cones also have bleachable pigments one each for red, green and blue. Brain blends these colors to make scores of other hues. Anything goes wrong with an intricate electrochemical process the person would be color blind. In dim-light activity of cones diminishes, color sense vanishes, rods takes over and the thing appear gray.

5. The lacrimal glands produce a steady stream of moisture-tears-to flush away dust and other foreign material.

6. Eyelid acts as windshield wipers, which blinks 3-6 times per minute and keep cornea moist and clean. Tears also contain a potent microbe killer called lysozyme to guard from infective bacteria.

The eye records our impression of the physical world, color, size, shape, gloss, glitter etc. However, eye is not a very good quantitative instrument, but very fine qualitatively. The visible spectrum of the eye lies in the wavelength range of 400nm (violet)-700nm(red.) The eye is most sensitive to differences in color is the green (520nm) to yellow (580nm) region.

7.2.3 COLOR

Colour is the general name for all sensations arising from activity of the retina of the human eye and its associated nervous mechanism when light reaches the retina. We must determine colours' intensity, dominant wavelength & colorimetric purity. Roughly, intensity is to amount of color the dominant wavelength is the predominant color (red, yellow etc.) and colorimetric purity is the relative amount of gray present.

When eye views an illuminated object, the color perceived is related to 3 factors :

1. Special composition of the light source
2. The chemical and physical characteristic of the object.
3. The spectral sensitivity properties of the eye

Color nomenclature is somewhat difficult to comprehend. Various systems are available and color maps are used to provide reference points.

7.2.4 COLOR CLASSIFICATION SYSTEMS :

1. C.I.E. SYSTEM : COMMISION INTERNATIONAL DE E'CLAIRAG – INTERANTIONAL COMMISION ON ILLUMINATION. It is the most important/commonly used for food color description. The C.I.E. system, a tri chromatic system, is based on the fact that a suitable mixture of three primary colors can match any color. The three primaries are red, green and blue. Any possible color can be presented as a point in a triangle. The relative amounts of 3 primaries required to match a given color are called the tri stimulus values of the color. The CIE primaries are imaginary, because there are no real primaries, which can be combined to match the highly saturated hues of the spectrum.

The amounts of x, y, z primaries require to produce a given color are calculated from:

I = spectral energy distribution of illumination

R = spectral reflectance of sample

Dh = small wavelength interval

x, y, z = red and green and blue factors.

The ratios of the primaries can be expressed as:

X = x/x+y+z, y = y/x+y+z and z = z/x+y+z

The quantities x and y are called the chromaticity co-ordinates. A plot of x v/s y results in CIE chromaticity diagram.

Achromatic colors are white, black and gray. Black and gray only differ from white in their relative reflection of incident light. The purples are non spectral chromatic colors. All other colors are chromatic. e.g. brown is a yellow of low lightness and low saturation. It has a dominant wavelength in the yellow or orange.

A color can be specified in terms of the tri stimulus value Y and the chromaticity co-ordinates x and y, value is a measure of luminous reflectance/ transmittance and is expressed in % simply as Y/100

Another method of expressing color is in terms of luminance, dominant wavelength and excitation purity, i.e. lightness, hue and saturation.

Lightness – relative luminous flux (reflected / transmitted)

Hue – senses of redness, yellowness etc.

Saturation – strength of hue/relative admixture with white.

One of the problems with this system is that the X, Y, and Z values have no relationship to color as perceived, even through a color is completely defined.

2. MUNSELL SYSTEM:

In color classification of this system, all colors are described by the three attributes of hue, value and chroma. It can be envisaged as a three dimensional system. The hue scale is based on ten hues, which are distributed on the circumference of the hue circle. There are five hues; red, yellow, green, blue and purple; written as R,Y,G,B,P and five intermediate hues; YR, GY,BG,PB and RP. Each of these ten hues is at the midpoint of a scale ranging from 1 to 10. The value scale is lightness scale ranging form 0(black) to 10(white.) This scale is distributed on a line perpendicular to the plane of the hue circle and going through its center (Fig.7.3).

The Munsell system of color classification

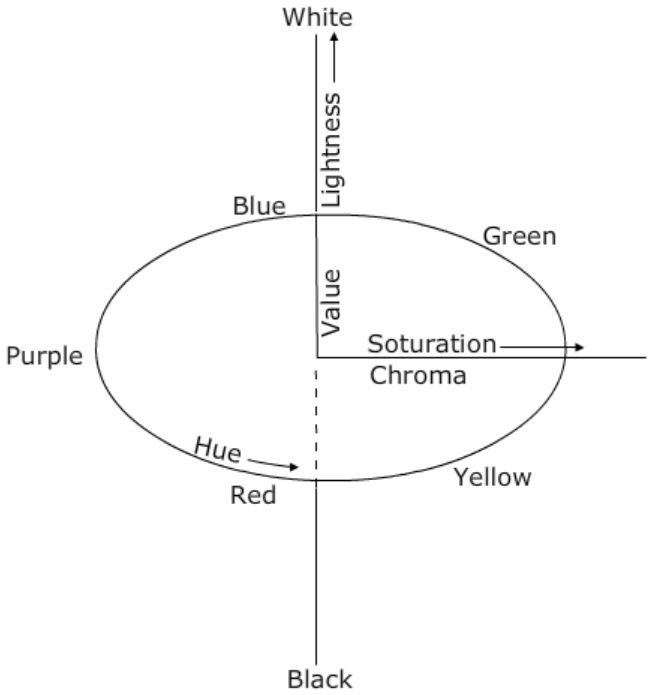

Fig.7.3 The Munsell system

Chroma is a measure of the difference of a color from a gray of the same lightness. It is a measure of purity. The chroma scale is of irregular length, and begins with zero for the central gray. The scale extends outward in step up to the limit of purity obtainable by available pigments.

The description of a color in the Moonless system is given as HIV/c, e.g. A color indicated as 5R 2.8/3.7 means a color with a red hue of 5r, a value of 2.8 and chroma of 3.7. All colors which a can be made available pigments are laid down as color chips in the Munsell book of color.

3. HUNTER SYSTEM :

To overcome the problem encountered in C.I.E. system, the Hunter system color classification, widely used for food colorimetry, have been suggested. The so – called uniform – color, opponent colors, color scales are based on the opponent-colors theory of color vision. In this theory, it is assumed that there is an intermediate signal switching stage between light receptors in the retina and the optic nerve which transmits color signals to the brain. In this switching mechanism red responses are compared with green and result in a red-to-green color dimension. The green response is compared with blue to give a yellow to blue color dimension. These two color dimensions are associated with the symbols a and b. The third color dimension is lightness, L, and is non-linear and usually indicated as the square or cube root of Y. This system can be represented by the color space shown in Fig.7.4.

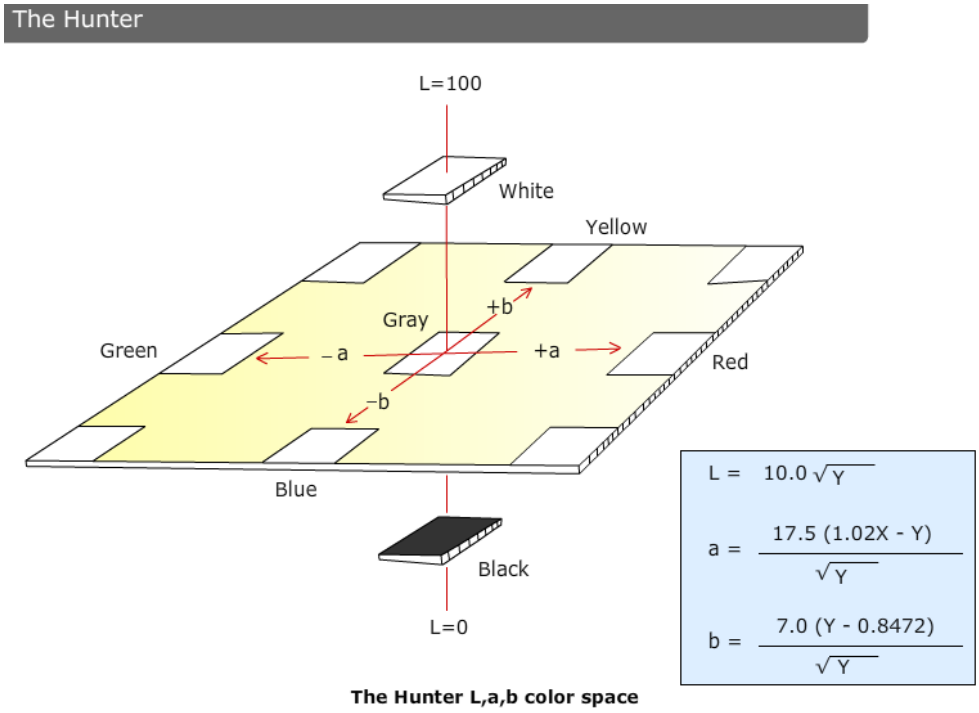

Fig.7.4 the Hunter System

The L, a, b, color solid is similar to the Munsell color space. The lightness scale is common to both. The chromatic spacing is different. In the Munsell system, there are the polar hue and chroma coordinates, whereas in the L, a, b, color space chromaticity is defined by rectangular a and b coordinates. CIE value can be converted directly by the use of equations as shown in Fig.7.5 into L, a, b, values and vice versa. This is not the case with Munsell values. There are obtained from visual comparison with color chips (called Munsell notations) or from instrumental measurements (called Munsell renotations), and conversion is difficult and tedious.

The L a b color solid is similar to the Munsell color space. The lightness scale is common to both. The chromatic spacing is different. In Munsell system there are the polar hue and chroma coordinates, whereas in the L, a, b color space chromaticity is defined by rectangular a and b coordinates.

7.3. AFTER IMAGES:

After images are known to occur (motion pictures depends upon them). These may be positive, with the same qualitative characteristics, or negative, i.e. with an antagonistic or complementary quality.

7.4. COLOR CONTRAST:

Color contrast is another phenomena. If a gray square is placed on a color surface the gray appears to be tinged with an antagonistic or complementary to the background color.

7.5. GLOSS:

In addition to the color, there is another important aspect of appearance, namely GLOSS. Gloss can be defined as '' the characteristic, which is related to the reflecting properties of the material''. Reflection of light can be diffused or undiffused (specular). In specular reflection, the surface of the object act as a mirror and the light is reflected in a highly directional manner.

Surfaces can, therefore, be classed on a scale going from a perfect mirror completely specular reflection to a surface reflecting in a completely diffuse manner. In the latter, the light from an incident beam to scatterness in all direction the surface is called matty.

The eye has the same physiological properties and limitations as the other sense organs. The most important are:

[a] absolute threshold

[b] differential threshold

[c] duality of reception

[d] adaptation

[e] hue and saturation

The effective light energy at the threshold is a few hundred billionth of an erg or 5-11 quantum.

At low light intensities, we can distinguish very small changes in light. – 30 jnd

7.5. ADAPTATION:

It is a phenomenon of all the sense. It is a decrease in response after exposure, If we remain in dark room for 30 min., the retina will become sensitive to 1/100000 the intensity needed to stimulate it before entering the dark room. In the light, sensitivity gradually decreases. Presumably the visual pigment rhodopsin in the eye is broken down in the light and has to be synthesized in the dark, lack of vitamin A has been shown to increase thresholds markedly.

Hue discrimination is dependent on the wavelength and on intensity bag if the intensity of a red light [660 nm] us sharply reduced, it is necessary to decrease the wavelength to maintain the hue. Saturation in purity discrimination is also important. Purity is the relative absence of grayness in colors.

7.6. FOOD PIGMENTS:

The colors of foods are the result of the presence of natural pigments or of added dyes. The pigments are a group of natural colorants found in animal and vegetable products. The artificial colorants are additives used to improve the appearance of foods, which would otherwise be unattractive. Both the groups of colorants are organic in nature. The naturally occurring group of pigments is generally considered to embrace the pigments already formed on heating storage or processing. These pigments can be divided into four groups:

1. TETRAPYRROLE COMPOUNDS: chlorophyll, hemes and billins.

2. ISOPRENOID DERIVATIVES: carotenoids

3. BENZOPYRAN DERIVATIVES: anthocyanins and flavonoids

4. ARTEFACTS: melanoid, caramels

The chlorophyll are characteristics of green vegetables and leaves. The Heme pigments are found in meat and fish. The carotenoids are a large group of compound widely distributed in animal and vegetable products. They

are found in fish, vegetables, fruits, eggs and dairy products. Cereals. Anthocyanins and flavonoids are found in root vegetable and fruits e.g. berry, grapes. Caramels and melanoidins are found in syrups and cereal products, especially, which are subjected to heat treatments.

Instrument used to measure color in foods are:

[1] ADDITIVE COLORIMETERS

[2] SUBTRACTIVE COLORIMETERS

[3] COMPARATORS

[4] SPECTROPHOTOMETERS

[5] TRISTIMULUS FILTER COLORIMETERS

*****☺*****

*****☺*****

Module 2. Requirement of sensory evaluation and physiology of Human senses

Lesson 8. Classification of tastes and odour, threshold value and its determination and factors

8.1 CLASSIFICATION OF TASTES:

8.1.1 Sweet Taste:

Substances, which elicit the sweet sensation, are primarily organic compounds. Alcohol (glycerol), salts (lead acetate), sugars, complex aromatics (saccharine), organometallic compounds (cyclamates) aldehyde (cinnamic aldehyde) etc. taste sweet. Not all sugars are equally sweet; Fructose gives the most intensely sweet taste, followed by sucrose, galactose and lactose.

Sweetness appears to be associated with hydroxyl (-OH) radicals on the sugar molecules. Lower sweet taste of some sugars attributed to the crumpling of the molecule, putting -OH groups so close that they get attracted to each other by H bonds, therefore not free to elicit sweet tastes. Sweetening agents used in food are toxic on long use and can be considered health hazardous. Saccharine -300 times, sucramine -700 times, cyclamates -30 times sweeter than sugar. Sweetness is particularly important in soft drinks, fruits and fruit juices, in honey and in many baked foods.

8.1.2 Sour Taste:

Sourness or the tart taste of acids, is .also important in fruits and fruit juices, and in fermented products. Lack of a certain amount of acidity results in flat & unpalatable taste in many foods. It is doubtful, if the acid taste has much protective value for man in food selection; even the most acid foods are not strong enough in acidity to be injurious to health.

The sour taste is associated with hydrogen ions supplied by acids like vinegar, those found in fruits, in acid salts. The intensity of sensation depends more on H ion concentration than the total acidity, but sourness and H-ion concentration do not run exactly parallel.

At equimolar concentration acetic acid tastes more acid than hydrochloric, although pH of the latter is lower, may be due to interactions of saliva and the acid compound.

Organic acids compared with inorganic acids at same pH will have a greater taste effect. Also, weak acids, which taste more acid than they should based on H ion concentration, may influence taste mechanisms other than the simple sour taste. Buffering action (of saliva) appears to playa role in determining the sourness of various acids.

8.1.3 Salty Taste:

Saltiness is much appreciated taste. It is due to ions of salts. Table salt is the most common salty taste in foods. Sodium chloride is said to be the only salty with pure salt sensation, even so, in dilute concentration it is frequently identified as sweet.

The taste of salt is dependent on the nature of both cation (Na+) and anion (CI-). As the molecular weight of either cation/anion/both increases the salts are likely to taste bitter. KCI and CaCl2 have a salty taste, but different from NaCI. Similar is the case is with Sodium Fluoride and Iodide.

The 'differences' may depend partially on other sensations -bitterness, feel, sweetness etc. The lead and beryllium salts of acetic acid have a sweet taste but are extremely toxic.

8.1.4 Bitter Taste:

The bitter taste is appreciated in beer, wines, and in some foods. It has little protective ! value to man in his selection of food, which is safe to eat. Bitter taste is widely distributed i & can be attributed by variety of inorganic & organic compounds.

Alkaloids (basic N containing organic compounds) -caffeine, theobromine, nicotine, and quinine are bitter. Glycosides of Phenolic compounds 'Naringin' -in grape fruit, Inorganic Salts -CsCI, CsBr, KI, and MgSO4 -bitter in taste Amino acids -phenylalanine, leucine, valine, and histidine -bitter. Bitter peptides -partial enzyme hydrolysis of proteins -are formed during cheese ripening.

Although, bitter taste by itself is usually considered as unpleasant, it is a common component of taste of many foods usually in combination with sweet and sour. Quinine is often used as a standard for bitter taste.

8.1.5 Other aspects of taste:

In addition to the individual tastes, there is important interrelationship between them.

1. The sugar to acid ratio -important role in fruits.
2. Alkaline taste -attributed to OH ions, an irritating effect on general nerves endings in the mouth.
3. Astringency -not taste but aspect of flavor, Borax is known for its astringency.
4. Coolness -Characteristic of menthol, a part of mint flavor complex.
5. Hotness -associated with spices, also known as pungency, non-volatile amides are responsible for heat effects.
6. Metallic taste -no receptor sites, but is real. It appears to be modality of common chemical sense like irritation & pain. It is generated by salts of metals like Hg, Ag, Fe, Cu, and tin. The lead salt of saccharine -intense sweet -gives metallic after taste. It is frequently associated with oxidized products. 'Oct-I-en-3-one' -responsible for metallic flavor in dairy products.
7. A drug 'gymneric acid' -renders taste bud insensitive to sweet & bitter, but no to salt and sour.
8. A berry grown in Africa, known as 'miracle fruit' when eaten sour food (lemon) - tastes sweet. The active substance coats the taste buds.
9. Salts reduces sourness of acids, certain acids increases saltiness.
10. Salt on one side of tongue, cause distilled water on other side to taste sweet or insipid i (tasteless). .
11. Salt on one side, sub threshold concentration of sucrose to the other -easily recognized as sweet/very sweet. A sugar solution on one side -enhances saltiness. A salt also sensitizes to salt.

8.2. TASTE THRESHOLD:

Thousands of threshold are reported in the literature. The data are not always comparable, because of differences in technique, impurities/type of Chemical used, inadequate number of tests, insufficient statistical analysis of their validity, plus undetermined factors such as order presentation, temp., time, experience, physical condition, age, sex and area stimulated. The average thresholds of some common chemical compounds are given in Table 8.1

TABLE 8.1 The average thresholds of some common chemical compounds.

8.2.1 Taste -Interaction:

Since foods contain mixture of substances, which elicit all four-taste sensations, the subject of taste interaction is of great interest to food technologist. In most of the cases, there is probably desensitizing effects i.e. an increase in threshold.

Salt reduces sourness of acids, sprinkling of salt on fruits increases the apparent sweetness of sucrose. A pinch of sugar may improve over salted soup. Sugar reduces bitterness of caffeine, sourness of acid. At higher concentration, the effect of second taste is generally to reduce the sensitivity of frost. Not all the people react the same.

8.2.2 Taste -Blindness:

Individuals may exhibit varied responses to taste stimuli of certain chemicals e.g. 1/4th of population is said to be 'taste-blind' to PTC (Phenyl-theo-carbamide), which contain -N- C" group. Being blind to a certain taste should not cause undue concern for the novice evaluator, since other factors play important role in judging dairy products. Most expert judges possess no special taste acuity.

8.3 Factors Affecting taste threshold / sensations:

(1) Diseases: Disease and Accident may result into loss of, decreased or altered, i temporary/permanent, and taste sensations. Irritating tongue of patient with X-rays or cobalt source reduced taste sensitivity of all tastes except sour. In case diabetes, sweet taste -in the absence of stimuli, bitter in the case of jaundice. Patients with adrenal insufficiency -increase sensitivity to all tastes.

(2) Effect of Sleep and Hunger: Lack of sleep, up to 72 hours, did not affect the thresholds to salt & sweet, but raised the sour threshold significantly. Sensitivity to 4 basic tastes -maximum at II :30 a.m., significant decrease for about 1 hr. after meal, followed by an increase in 3-4 hr. Little influence on preference. Fasting from breakfast until 4:30 p.m. -no effect.

(3) Age : New born to 40 days -no/little taste differentiation. Higher sweet threshold - 52 to 85 yr. group than 15 to 19 yr. A decrease in taste sensitivity after 60-yr. Age, may be because of degenerative changes in taste receptors, particularly for sweet & sour, no change for salt & bitter. Differential sensitivity -less in children 7-11 yr.

(4) Smoking: Smoking affect taste preferences via taste mechanism. No effect on threshold for sweet, sour, slat but for bitter was higher in smokers. Nicotine & other alkaloids plus smoke -fatigue the perception mechanism. No significant effects on receptors have also been reported.

(5) Other factors: Chronic alcoholism -excessive smoking -allergy -hay fever -badly infected germs -marked tooth decay did not affect the sensitivity to sucrose. Water unless purified is a factor. Practice is another factor-increased familiarity.

Related to threshold is the ability to distinguish intermediate concentrations. At lower concentration the solution chosen, was greater than half concentration, Quinine Sulphate was an exception.

(6) Effect of temperature on taste:

The effect is not uniform.

1. Sucrose & HCI 35-50'C optimum temperature.
2. Saltiness~ 18-35'C, Quinine~ 10'C
3. NaCI~ 10'C, at or near threshold concentration~ bitter taste.

Increased temperature -increased response to sweet

-decreased response to salty & bitter

-unchanged sensitivity to acid

To study the effect of temperature one requires

- control of area stimulated

- the rate with which the liquid passes over tongue.

It is difficult to separate taste, temp. & pain effects. Moreover, temp. of receptor may be more important than temperature. of sapid substance. Fluids of extreme temperature. (especially extreme cold) cause temporary insensitivity. Optimum sensitivity to taste producing substance occurs at 30-40'C. The sapid substance should be neither so cold nor so warm as to distract attention from the taste reaction. For judging milk-a temp of about 60'F (15.5'C) is more preferred which is not cold enough to have distracting influence and not warm enough to volatative completely all the odors, that may be present. Further, volatilization may occur as the temperature. of the milk is brought upto the body temperature (98.6'F).

(7) Effect of taste medium:

The intensity of the taste medium is greater in aqueous media than in paraffin oil/mineral oil. This is supposed to be due to: combined effects of viscosity and solubility of the compounds in oil and of the oil in saliva.

(8) Chemical configuration/structure and taste: The relationship between the chemical structure of a compound and a taste is more easily established than between structure and smell. All acids are sour, NaCI and other salts are salty, but as the constituent atoms get bigger, bitter taste develops. Taste responses are related to chemical specificity, therefore, ortho, meta or para positions of different groups in compound alter these tastes. Minor changes in the chemical structure may change the taste of a compound from sweet to bitter or tasteless. Stereo structure, optical relation (levo or dextro) etc. may also alter tastes, because these behave differently on taste receptors.

8.4 CLASSIFICATION OF ODORS:

Just as the various taste reactions were resolved into four basic categories, attempts have been made by numerous investigators to classify odors:

1. A four modular classification: Any odorous substance has four components which include fragrant described as flowery or fruity); acid or sharp; burnt or tarry or scorched; and caprylic or goat like.

2. Six odor groupings: In diagrammatically arranged six fundamental odors in which interrelated or intermediate odors are shown as components of an olfactory prism. On a close examination of the prim , one can observe that a given odor can either be a fundamental odor by a occupying a corner when two odors are involved, they, would be located along an edge, or if three odors are involved, they would be located on a triangular surface.

3. Simplified six odor sel1sation to four odour grouping:

With a range of intensity of stimuli for each of the four basic odors numbered to 0 to 3, they reproduced odors simply by mixing certain intensity of the basic odours. Within this format given aromatic substance may contain all four fundamental odors, their relative degrees of stimulation determine the individuality oftl1at odor.

Most persons could differentiate between 2000-4000 odors, whereas highly trained persons could probably differentiate as many as 10000 different odors.

4. There are seven primary classes of odors: This include ethereal, camphoraceous, musky, floral, minty, pungent and putrid.

Certain perceived odors might be considered to be a composite or two or more primary odors, a dairy products judge should be alert to possible detection of individual components. Sense acuity of an individual may not involve but power & value of concentration, which is very important, can be materially improved.

8.5 ODOUR THRESHOLDS:

The apparent olfactory thresholds for the most powerful odors are about 10000 times lower than the lowest taste thresholds. Differential sensitivity to taste, appears to be finer than it is to odor. Typical thresholds are given in Table 8.1 Fatigue is also more rapid and permanent with smell than with taste, sight or hearing.

Table 8.2 TYPICAL THRESHOLD:

8.6 Factors affecting threshold:

There are several factors which affecting the threshold. These are

[a] PURITY OF COMPOUNDS: purity is necessary for threshold tests.

[b] EXTERNAL VARIABLES: -duration and rate of flow of inspired or injected air I

reduction in olfactory acuity in the presence of noise. i -contrast between humid external and dry interior condition leads to increased sensitivity.

-methods of presentation of samples greatly influenced the results. -error of habituation.

[c] EFFECT OF HUNGER AND CHEMICALS: increase in sensitivity during morning and a rapid decrease after a meal. Alcohol and sugar decrease olfactory sensitivity.

[d] INDIVIDUAL VARIATION: in order threshold not only a matter of definition and technique but also related to differences in the physiological state of the nose.

8.7 TECHNIQUES FOR SENSORY EVALUATION OF FOOD ODORS:

OLFACTOMETER:

It is an air-diluents method consisting of a measured amount of odorous material sealed in a small, thin walled glass tube placed inside a larger container. The small tube was broken, and the subject opened the container and sniffed the contents. If the subject could detect the odor, the test was repeated with the same quantity of material in larger containers, until the odor was no longer recognizable.

Major errors associated with this technique-included adsorption of the test material on the glass, dilution when container is opened and difficulty in weighing volatile material.

A large number of similar technique developed, such as, using diluents air, compressed inert gas, mineral solvents, benzyl benzoate, glycerol or diethyl phthalate

a. Olfactometer:

An instrument for controlled volume temperature humidity flow rate, presentation of odor stimuli, used for measuring threshold and other quantitative values.

b. Sniffing Method:

Sniffing from beakers or bottle is the most widely used method of measuring odor intensity and quality. Although sniffing is the most simple and economical of all procedures. Certain limitations detract from its usefulness. The presence of non-ideal solutions at or near the threshold was a serious problem, suggesting that the procedure be used with caution when dilution of the odorous material is necessary. The method can be used for routine quality control purposes, such as measuring odors in drinking water, but more precise studies of olfactory response require presentation of odors under highly controlled conditions.

8.8 PHYSICAL AND CHEMICAL TECHNIQUES:

1. Gas-liquid partition chromatography.
2. Flame ionization.
3. Electron capture technique.
4. EMF flavor test.
5. Psychogalvanic skin response (PGSR). –

*****☺*****

Module 2. Requirement of sensory evaluation and physiology of human senses

Lesson 9. Measurement of sensation intensity

9.1 MEASUREMENT OF SENSATION INTENSITY:

9.1.1 THRESHOLD VALUE:

It can be defined as "statistically" determined point on the "stimulus scale" at which occurs a transition in a series of sensations. Several types of threshold have served as important tool in developing better understandings of the relationships between magnitude of stimulus and perceived sensation.

9.1.2 ABSOLUTE THRESHOLD:

"The least energy capable of producing a sensation" Sensation changes in lawful or predictable manner as the stimulus energy is increased, but changes in different way to each sense.

9.1.3 DETECTION/ STIMULUS THRESHOLD:

That magnitude of stimulus at which transition occurs from no perceived sensation to a perceived sensation (RL), similar to absolute threshold.

9.1.4 DIFFERENCE THRESHOLD (DL):

The least amount of change of a given stimulus necessary to produce a change in sensation, and the interval/unit of differences is designated as "JND" just noticeable difference.

9.1.5 RECOGNITION THRESHOLD (IDENTIFICATION):

It is the minimum concentration at which a substance is correctly identified.

9.1.7 TERMINAL THRESHOLD::

It is that magnitude of stimulus above, which there is no increase in perceived intensity of quality for stimulus. Above this point, pain occurs to the subject.

9.2 RELATION BETWEEN STIMULUS AND PERCEPTION :

Functional Relationship between above two is dealt by "Psychophysics".

The three parameters:

1. Task undertaken by the observer
2. The manner of presenting the stimulus, and
3. Statistical measure used to describe the data.

9.3 PSYCHOLOGICAL ERRORS IN JUDGMENT:

1. The error of habituation: results from a tendency to continue to give the same response when a series of slowly increasing/decreasing stimulus is presented.
2. The error of expectation: include the overly anxious observer to find a difference when none exists.

3. A stimulus error: results when a subject knows that the test is being given in a certain way or when containers used or the procedure followed suggest differences and therefore cause him to find them when they do not exist.
4. The Logical error: occurs when two characteristics of a food, which are logically associated in the minds of the observer, are rated the same.
5. The error of Leniency: applies to ratings where bias in favour of some person or some object causes the observer to rate them higher than they should.
6. Error of Central Tendency: arising in the tests involving judgment, rather hesitant to use the extreme values on a scale. This error probably also applies in sensory evaluation of unfamiliar foods.
7. The Contrast error: may be noted, where expected or preferred method of evaluation is not followed. Foods may the be rated lower than with expected method; also, when a poor sample follows a good sample, the contrast error appears greater than when they re judged separately.
8. The Proximity error: associated with judging scales, is attributed to the fact that adjacent traits tend to be rated similarly. Simultaneous scoring of color, texture, odor, taste & acceptability on the same set of samples can give different scores from those obtained when each trait is judged individually.
9. A Time error or positional bias: i.e. over selection of one sample on the basis of its order of presentation, has been demonstrated in paired tests.
10. The Association error: is tendency to repeat previous impressions -a form of conditioned response.

Error of the First and Second kind:
Failure to detect a stimulus that is actually present is called and error of the First kind.
Reporting a signal when no stimulus is present is called an error of the Second kind.
These errors may be caused by expectation and can be influence by motivation.
The most effective method of improving ratings, and thereby reducing psychological errors, is to train judges, carefully. Training that includes practice, followed by group discussion, has been recommended as being most effective.

ADAPTATION:

When an exposure to a stimulus is prolonged, sensory response declines, i.e. adaptation occurs. This applies to direct sensory response as well as electrical activity. Complete Adaptation, i.e. no response, is possible but is certainly of little importance in the sensory examination of foods. Adaptation appears to be due to some special inhibition of the cell receptor membrane in the case of taste, rather than exhaustion of some receptive substance in the cell. Adaptation is relatively slow at higher concentration. Recovery from adaptation is rapid at first and slows thereafter.

1. The task may be:
Classification: whether the stimulus is present/absent.
Order: the stimulus is greater/lesser
Intervals: the apparent difference between two/more perceptions.
Ratio: report the ratio of magnitude of perceptions.
Magnitude: the magnitude of a perception.

2. Two types of the stimuli arrangement are commonly used.
(I) Fixed Stimuli: not varied during the observation.
(2) Adjustable Stimuli: may be altered during experiment.

Statistical Measures:
Usually involve measures of central tendency -median and measures of variability.
Discrimination: relates how two stimuli differ.
Scaling considers how much of stimulus present.

Module 3. Fundamental rules, score card and sensory testes

Lesson 10. Fundamental rules for sensory evaluation

10.1 INTRODUCTION

To become good judge, following are the most important requirements are:

1. Mastery of certain techniques for good understanding of the procedures in examining dairy products.
2. Follow the fundamental rules of sensory evaluation of dairy products and
3. Efficient use of time in scoring a number of samples actually results in the judge having more time at his disposal for scoring and rechecking each sample.

To obtain confidence in judging and grading dairy products, the understanding of different fundamental rules is very important.

10.2 FUNDAMENTAL RULES:

10.2.1 Be in physical and mental condition for scoring.

The person /object should have good health, physical comfort and mental poise. The important suggestions which are helpful in judging are as under.

a). The eating of heavy meal just prior to judging leads to dull the appetite, and to destroy the enthusiasm for tasting and the sensitivity of taste.

b). Avoid judging of diary products after having eaten foods of strong flavor such as cabbage, turnips, or onions.

c). The use of tobacco is generally detrimental to the development of the senses of taste and smell, it must be admitted that some dairy products' judges noted for their abilities to judge are inveterate smokers. In some cases it is believed that the use of tobacco is not harmful to one's judging ability.

d). The use of mild - flavored pepsin chewing gum prior to judging is considered beneficial to the flow of saliva thus preparing the tongue and palate for the sapid substances.

Chewing appears to stimulating the flow of saliva and have a nerve quieting effect.

e). The sensory evaluation room should be clean, well ventilated, well lighted and tempered to contribute to the physical comfort of the judge.

f). Wash room facilities should be available. The mouth should be rinsed with plain water prior to judging. Likewise, the hands should be scrubbed, using a non-fragrant soap.

10.2.2. The person should have the knowledge of the score card or the ideals established for each product.

The score card is an important tool for the dairy products' judge.. Be able to recall instantly the numerical value of each item.

10.2.3. Have the ability to grade each dairy product and to judge the defect intensities allowed in each grade.

The judge must have ability to identify the defects and their intensities for flavor, body and texture, colour and appearance etc of the product. He should has the knowledge of the relative desirability or undesirability of each in terms of numerical values. Thus, to judge a product one must know what to expect in the way of quality of each product.

10.2.4 The samples should be properly tempered.

The flavor and the body and texture can be determined best when the products are neither too cold nor too warm. Therefore, each product should be tempered specifically for particular dairy product. The ice cream and butter, cheese and milk are required to be tempered around 5C to 10F. (- 15 to - 12.2 C.) 60F. (15.5C) respectively to the study of the various qualities. If the products are too cold, the taste buds may be temporarily anesthetized during which time some of the delicate, elusive flavour may pass off undetected. On the other hand, if the products are too warm, an accurate evaluation of some of the qualities is very difficult.

10.2.5. The sample to be judged should be a representative portion of a lot.

The sample should be taken accurately and be representative of whole lot. Regardless of the type of sampling tool, always cut out the portion to be examined, if possible, rather than scraping compressing, or twisting it out. Avoid taking the sample from near edge. Never take a surface portion, or a trier plug which touches an opening from where a previous, or a trier plug which touches an opening from where a previous sample had been removed. In case of liquid products, as milk, buttermilk, or cream, be certain the product is well mixed before sampling.

10.2.6. Observe the aroma immediately after removal of the sample.

This is a good judging habit to form early in one's judging experience The best time to smell a sample is when the freshly cut surface is first exposed to the air. If the aroma is not observed then, its true intensity may never be recorded. Other qualities of the product may be examined after noting the smell, since they remain fairly constant. The importance of examining the aroma of the sample immediately upon removal of such sample cannot be overemphasized. Bear in mind always that the nose is far more sensitive than the tongue :

"As little as one billionth of a milligram of an aromatic vapor is detectable by the human nose. In order to taste the same substance, the tongue requires a million times as much. the significance of this ratio is not generally appreciated by food processors."

10.2.7. Introduce sufficiently large volume of the product into the mouth for tasting.

The sample should be large enough that delicate flavors may be detected, and yet sufficiently small to permit easy manipulation of the warmed sample in the mouth. Be in no hurry to expectorate the sample. It should be rendered completely liquid and warmed to body temperature before being rejected. Hold each sample approximately the same length of time in the mouth regardless of the quality of the product. The sample tasted is rarely swallowed and then only on specific occasions.

10.2.8.Fix the proper ideal quality of products in mind.

This can best be done by working closely with a sample recognized as having superior quality. Learn to recognize when and in what respect a sample fails to compare favorably with the ideal. Without the attainment of this mental guide or standard, the amateur judge has no "yardstick" by which to measure the products. The earlier the ideal quality of a product is grasped the sooner will the beginner become proficient in judging and grading dairy products.

10.2.9. Observe the sequence of flavors.

The sensory reactions for specific flavors remain the same. They may be depended upon to give the same sensations the next time they are brought into contact with the sense organs. Remember these sensations and correlate them as early as possible with the specific flavor. After expectorating, note how long before the taste sensation disappears.

10..2.10 Recondition the mouth occasionally

The mouth should be cleansed or reconditioned at intervals of tasting, especially after having examined a poor sample. This may be done satisfactorily by

a). rinsing the mouth with clean warm water or warm water to which a small amount of salt has been added.

b). rinsing the mouth with water or with one of the solutions reconditions the mouth satisfactorily after having tasted milk and ice cream.

c). the use of salt water or fruit seems best suited for conditioning the mouth after having tasted butter and cheese.

d). use clean warm water to aid in keeping the mouth in condition after having tested products such as buttermilk, cultures, or cultured cream.

e). eating portions of sound firm fruit, such as an apple or a pear.

10.2.11 Practice introspection.

That is, close the eyes and mind to the world about you and practice self examination so far as tasting is concerned. Look back into your own mind and make mental records of the taste and smell reactions. In other words, concentrate upon the sample being examined to the exclusion of everything else. Practice concentration during scoring of a sample until it becomes a fixed habit of judging. Relax after having finished scoring the sample. Sustained concentration is tiring. Unless accompanied by alternate period of relaxation, concentration may finally undermine the mental poise so necessary to good judging.

10.2.12. Do not be too critical.

The taste and aroma of the sample requires careful observation. The questionable habit of trying to find objectionable flavors which may not be present contributes much toward the improvement of the imagination but does little to increase one's judging ability. However, be certain that the sample has been well examined and whether defects are present. Give the sample the benefit of the doubt. In addition, keep an open mind in judging. Once the mind is made up do not change it.

10..2.13. Check your own scoring occasionally.

This can best be done by comparing the flavors of two or more identically scored samples and observing whether the flavors are scored consistently. Frequently, a good check on consistency of scoring should be made by re-scoring unknown samples without knowing their identity. Re-scoring unknown samples identically with the first scoring contributes much to the establishment of confidence and mental poise in the developing amateur judge..

10..2.14 Be honest with yourself.

Make your self use independent judgment. Judge the sample itself and should not be influenced by the name, the trade-mark on the package or by the score previously given a like product from a particular plant.. Have no part in attempting to identify samples set out to judge. Concentrate on judging the samples at hand. He should keep a

straight face and by so doing avoid telegraphing his observations intentionally or otherwise to another judge. Make your own decisions, and after arriving at a conclusion, believe in your own judgment until shown otherwise.

110..2.15. Recognize the fact that practice and experience are essential to the development of judging ability.

To develop the ability to taste, smell, and distinguish the delicate, one must practice judging of dairy products. Do not become discouraged too easily. Frequenataly, all that is needed to reveal powers of taste and smell is training and practice. Concentration, perseverance, and continued actual judging practice will yield astonishing results.

*****☺*****

Module 3. Fundamental rules, score card and sensory testes

Lesson 11. Score card and grading of milk and milk product

11.1 INTRODUCTION:

A score card is a tabulated list of sensory attributes contributing toward the quality of a product with a numerical value assigned to each attributes. These attributes are usually arranged on the card in the order of their importance i.e. flavour, body & texture, colour & appearance, package etc., The sum of the numerical ratings or evaluations of all essential attributes is always 100. However it may changes depending upon the recommendation made by different organization like ADSA (American Dairy Science Association) Thus, the score card can be used as numerical standard by which the quality of the various dairy products can be evaluated.

It is necessary to use laboratory equipment and facilities to determine the rating of some of the attributes while sensory evaluation of certain dairy products. Hence , the complete scoring of the product in one period is difficult. During sensory evaluation of such dairy products or in student judging contest where laboratory equipment is not available or when results are wanted immediately, only those factors that can be readily determined are considered. A card listing those attributes with their values is known as student score card. Obviously, the sum of the numerical rating on the student score card is always less than 100. These abbreviated score cards are useful in comparing the quality of different dairy products under immediate requirement of the result. The education importance of score cards in dairy industry has long been appreciated.

11.2 IMPORTANCE:

1. The score card provides a definite systematic means of arriving at a concise value of the product being scored.
2. The use of the score card enables the amateur judge to establish accurate judging habits by following a definite, orderly routing, thus requiring a minimum of time and effort to accomplish a definite result.
3. Score cards that contain a list of criticisms under each item are very helpful in pointing out the possible defects that may be found in the product.

Thus, the use of a score card has many advantages, namely,

(a) education,

(b) formation of correct judging habits,

(c) elimination of errors,

(d) saving of time,

(e) furnishing a permanent record and

(f) serving as a guide to the improvement of quality.

11.3 MAKE UP OR CONTENTS OF SCORE CARD

The uniformity in the score cards is essential with the advancement of judging . Score card should contains following information.

a). Near the top center appears the name of the product.

b). To one side there is a blank space for the number of name of the contestant or judge.

c). Below this, listed down the left side, usually in order of decreasing numerical importance, are the different items or factors to be considered in scoring the product.

d). Directly opposite the items for consideration are placed the relative value of each item..

e). Adjacent to the column of numerical values is a blank column in which the actual evaluations of the items are to be written.

f). Space is also generally allowed to check criticisms or for the judge to write in his comments.

The use of different colored score cards for each dairy product helps materially in sorting the cards when several different products are scored in a judging contest.

11.4 SCORE CARDS USED:

The score cards are generally available for all the principal dairy products. One standard score card cannot be made up satisfactorily for scoring all of the various dairy products since each product differs very materially in its characteristics.

Some differences are often noticed d in the form of arrangement of the score card, depending upon the use made of it. However, the basic points of consideration and their relative importance remain unaltered.

11.5 USE OF THE SCORE CARD AS A RECORD.

Since the score card is to be retained as a permanent record of the score of the product, erasures, strike - outs and untidy score cards should be eliminated by thinking through the process of judging and arriving at a definite conclusion before recording any scores. Erasures and strike-outs reveal uncertainty and lack of confidence on the part of the judge.

11.6 MARKING UP THE SCORE.

In marking up the score of a product, the general practice followed is to write down the points allowed rather than the deductions made. This method is both convenient and desirable..

11.7 WRITING DOWN EROTICISMS.

One who evades a definite decision and avoids specifically designating the characteristic flavor whether the flavor is excellent, medium, or poor, develops slowly in judging proficiency. Thus, in using the score card effectively, writing down or checking criticisms is very important.

11.8 GENERAL METHODS OF USING THE SCORE CARD.

General Statements regarding the use of the score card may be made. No dairy products are given a perfect score even by an experienced judge. Deductions are always made on some item. Flavor, for example, is never allowed the perfect score. If flavor were scored perfect, then the acme of quality would have been attained and should a more desirable flavor be found it would be necessary to devise a new score card.

The maximum deduction made depends entirely upon the item considered, which varies with the different products. There are no percentage rating that might serve as a guide. Items which deal with body and texture, color, package and salt in butter are generally given full rating. Even the most serious defects in these items, which often deserve a maximum deduction, are of insufficient importance to warrant a deduction of more than 20 percent of the total value of the item. Some tolerance must be made for regional characteristics and preferences.

11.9 USE OF THE OFFICIAL SCORE

To get the most good from the use of the score card the beginner must keep in mind that experience has always been and will continue to be a great teacher and that he must use every opportunity to profit thereby. For example, after definitely deciding on the flavor, and having arrived at a final score for the several samples judged, the beginner should compare intelligently the flavours and his evaluation of them. .

11.10 SATISFACTORY SCORING.

The beginner will discover early in his work that even the best judges themselves will sometimes disagree as to the final score of the product judged. This, however, is no cause for alarm or discouragement. the fact remains that experienced judges score sample after sample, placing on them scores remarkably close to each other. The flavors noted are more often in perfect agreement, yet the evaluations of these flavors differ slightly, depending on their relative importance, as viewed by the judge, and the intensity or volume of flavor. As long as mental processes, abilities of perception, keenness of the senses of smell and taste, and evaluation of sensed flavors differ with individuals, then there may be expected a variation in some scores of a number of samples of dairy products.

11.11 DAIRY PRODUCTS GRADING OUTLINES:

In routine examination of dairy products, special report cards are to be used to record the findings. These report cards differ according to the product examined and according to the processing plant in which they are used. In general, these outlines have provision for recording information on the various items which appear on the score card, but make no provision for recording numerical scores. In addition, space is often provided for recording further information which is not called for on the score card, regarding the quality of the sample. The items on the product examination, or grading outlines are usually those about which the consumer would be most concerned in purchasing a safe, high-quality dairy product. Such outlines have great utility value in dairy product quality control work.

*****  *****

Module 3. Fundamental Rules, Score Card and Sensory Taste

Lesson 12. Sensory Tests – difference tests (paired comparison, due – trio, triangle), ranking, scoring, hedonic scale and descriptive tests

12.0INTRODUCTION

The main purposes of Sensory testare:

· Select qualified judges and study humanperception of food attributes

· Correlate sensory with chemical and physicalmeasurement

· Study processing effects, maintainquality, evaluate raw material selection, establish storage stability or reducecosts

· Evaluate quality or

· Determine consumer reaction

12.1 CLASSIFICATION OF SENSORY TESTS

Each of these purposesrequires appropriate tests. There are a substantial number of test methods andnew methods continue to be developed. Sensory tests are classified intofollowing three categories.

Category	Test Type
Discriminative	Difference: paired comparison, due trio, triangle
Descriptive	Descriptive analysis: Flavour and texture profile. QDA
Affective	Acceptance preference: 9 point hedonic

12.2. DISCRIMINATIVE TESTING

This is one ofthe most useful analytical tools available to the sensory professionals. It ison the basis of a perceived difference between two products that one canjustify proceeding to a descriptive test in order to identify the basis for thedifference. Within this general class are a variety of specific methods e.g.

· Paired comparison test

· Duo – Trio test

· Triangle test

· Multiple sample test

· Other test methods such as dual andmultiple standard test.

- The main objective of all these methods is to answer a simple question. " Are the products perceived as different"? Obviously the response to this question can have major consequences. If the conclusions from a discrimination test are to be accepted by management as reliable, valid and believable, then it is important that each test be conducted with proper consideration for all aspects of the test design, product preparation and handling implementation, data analysis and interpretation **.**

12.2.1. PAIRED COMPARISON TEST

Thepaired comparison procedure is used in discrimination testing to food andbeverage evaluation. It has also been used successfully for determinations ofthreshold for basic taste solutions. The paired comparison test is a twoproduct test, and the panelist task is to indicate the one that has more of adesignated characteristic such as sweetness, tenderness or skinniness. Thismethod is also identified as a directional paired comparison test, the"directional" component altering the panelist to a specific type of pairedtest. The paired comparison test is relatively easy to organize and toimplement. The two coded products (AA, BB, AB, BA) are served simultaneouslyand the subject has to decide whether "there is difference" or "there is nodifference". Requiring a "difference" response in all cases has been found togive better results.

Anotherversion of the paired test is the A – not – A procedure. The subject ispresented with a single sample for evaluation, which is then replaced by asecond sample. The subject then makes a decision as to whether the product arethe same (or different). This particular test procedure has considerable merit inthose situations where non test variables such as a colour difference mayinfluence results.

12.2.2. Due – trio and triangle test

The Due – Triotest is suitable for products that have relatively intense taste, odour and orkinesthetic effects such that the sensitivity is significantly reduce. It lendsitself to use for quality control and for selection of judges for superiordiscrimination. The chance probability associated with the due – trio test isidentical with that of the other two product test. Whenever products are beingcompared with a current franchise (i.e. product now being manufacture), the due– trio, constant – reference test method, is most appropriate.

Thechance probability associate with the three product (triangle) test is only1/3, which accounts for its claim of greater sensitivity. The triangle test isa more difficult test because the subject must recall the sensorycharacteristics of two products before evaluating a third and then making adecision. In fact, the test can be viewed as a combination of three paired test (A-B, A-C and B-C). Products that have intense flavours and aromas that arespicy and / or are difficult to remove from palate, or that have physiologicaleffects (distilled beverages) usually preclude the use of the triarigle test.

12.2.3. Multiple Sample test

Testsinvolving more than 3 stimuli are classified as multiple sample tests. They mayhave equal (symmetrical) or unequal (asymmetrical) numbers of each stimulus.When they are applied as true difference tests, the judge is required toseparate the samples into two groups or like samples. When they are applied asdirectional tests, the judge is asked to identify the groups or higher or lowerintensity or a given criterion. Difference test designs involving more than three stimuli have hadonly limited use. The limitation is based on the increase in psychologicalcomplexity and physiological fatigue which accompanies an increase in thenumber of stimuli. In addition, large quantity of samples are required and moretime is needed for the observer to make a decision. These test appear to bemost applicable to visual discrimination, where the judge does not rely onmemory and fatigue is almost non – existent.

12.2.4. Dual Standard test

Thedual standards method was proposed for use in quality control situations. Thesubject is served four products: two are identified as references A and B andTwo are coded. The subject must match the reference product with

the codedproduct. The designation of the two references could reflect quality controllimits or current production and product outside the limit.

12.2.5. MultipleStandards Test

Thistest was developed for odour evaluation when a non – uniform standard was to becompared with an unknown. Any number of the questionable standards arepresented simultaneously with the unknown and the subject is asked to designatethe one which is most different. The chance probability of identifying theunknown correctly is ones over the total numbers of samples involved.

Some sensory professionals suggest that the triangle is more sensitivethan the due – trio the paired test, while the others have arrived at contraryconclusions. The various difference tests can be ranked in terms of increasingsensitivity as: paired, dual standard, duo – trio, triangle and multiplestandard. Recently All discrimination tests are equally sensitive.

12.3. DESCRIPTIVE ANALYSIS

Descriptiveanalysis is a sensory methodology that provides quantitative descriptions ofproducts based on the perceptions of a group of qualified subjects. It is atotal sensory description taking into account all sensations that are perceived– visual, auditory, olfactory, kinesthetic, and so on – when the product isevaluated. Descriptive analysis results provide complete sensory descriptionsof an array of products and provide a basis for determining those sensoryattributes that the important to acceptance. The results enable one to relatespecific process variables to specific changes in some of the sensoryattributes of a product. From the product development view point, descriptiveinformation is essential in finding out those product variable that aredifferent and from which one can establish cause and effect relationships.

Screeningshould be product category specific as is the subsequent training effort. Training is primarily focused on development of descriptive language which isused as a basic from scoring the product. A part from this the other importantactivities that are part of training include, the grouping of attributes bymodality (i.e. appearance attributes, aroma attributes and so on), them byoccurrence, developing a definition for each attribute, identifying helpfulreferences for use during training and familiarizing the subjects with thescoring procedure. There are numerous applications for descriptive analysis,including monitoring competitions, storage stability / shelf life, productdevelopment, quality control, physical / chemical and sensory correlation, etc.Depending upon the test methods used the training can be quite different.

12.3.1. Flavour Profile

The flavourprofile method is the only formal qualitative descriptive procedure and isprobably the most well known of sensory test methods. This method utilizes apanel of four to six screened and selected subjects who first examine and thendiscuss the product in an open session. Once agreement is reached on thedescription of the product the panel leader summarizes the results in reportform. The method has considerable appeal because results could be obtainedrapidly and would obviate the need for statistics.

12.3.2. Texture Profile

This methodrepresents an advancement in descriptive analysis with respect to developmentof descriptive terminology, the scales for recording intensities and the word /product anchors for each scale category. In developing the method, theobjective was to eliminate problems of subject variability, allow directcomparison of results with known materials and provide a relationship withinstrument measures. There is considerable appeal to the direct link betweenspecific instrumental measures of these rheological properties of a product andthe responses of a panel of specific sensory attributes, for example, texturometer units and hardness sensory rating. However, separation of texturefrom other sensory properties of a product such as colour, aroma, tests and soforth limits the total perception of the product's sensory properties.

12.3.3. Quantitative descriptive analysis

The quantitativedescriptive analysis (QDA) method was developed with an approach that wasprimarily behavioral in orientation with a consensus approach to languagedevelopment, use of replication for assessing subject and attributesensitivity, and for identifying specific product differences and definedstatistical analysis. The development of method evolved from a number ofconsiderations to ensure that it would:

· Be responsive to all the sensoryproperties of a product.

· Rely on a limited number of subjects foreach test

· Use subjects qualified beforeparticipation

· Be able to evaluate multiple product inindividual booths

· Use a language development process freefrom leader influence

· Be quantitative and use a repeatedtrials design

· Have a useful data analysis system.

In a QDA test, thesubjects evaluate all of the products on an attribute by a attribute basis onmore than a single occasion.

12.3.4. Other Methods

The spectrum descriptive analysis involves extensive training activities, reflecting the basic Flavour and Texture Profile procedures, with particularreliance on training the subjects with specific standards of specifiedintensities. Free choice profiling is another approach in which no subjectscreening or training are required and the subject can use any words they wantto describe the products being evaluated. The time advantage may, however, actually not be there since the experimenter requires to spend time explainingthe testing procedures to the subject.

12.3.5. Scoring

The most frequentlyused of all sensory testing systems is scoring because of its diversity, apparent simplicity, and ease of statistical analysis. Scoring methods havemost extensively been used by the dairy industry for product development andimprovements, shelf life studies and assessing suitability of packagingmaterials. Score cards base on 100 points are generally used for judging andgrading of dairy products. Most recently 25 points score cards have beensuggested. It is believed that numerical rating tests give more completeinformation than either ranking tests or descriptive rating test. But thejudges must be trained. Since there is no indication of liking to the testproduct, palatability norms should be established. The score card must beproperly developed giving due weight age to all the sensory attributes.

12.4. AFFECTIVE TESTING

Acceptance testing avaluable and necessary component of every sensory programme is performed atconsumer's levels. It refers to measuring liking or preference for a product.Preference can be measured directly by comparison of two or more products witheach other, that is, which one of the two or more products is preferred.Indirect measurement of preference is achieved by determining which product isscored significantly higher than another product in a multiproduct test, orwhich product is scored higher than another by significantly more people. Thesetwo methods most frequently used to directly measure preference and acceptanceare the paired comparison test and the nine point hedonic scale. Other methodsare either modifications of these two methods or are types of quality scale:for example, excellent to poor and palatable to unpalatable.

12.4.1. Hedonicscale

Thenine point hedonic scale has been used extensively since its development with awide variety of products and with considerable success. The scale is easilyunderstood by naive consumers with minimal instruction and the productdifferences are reproducible with different groups of subjects. The resultsfrom use of this scale are most informative since computations will yieldmeans, variance measures and frequency distributions, all by order ofpresentation and magnitude of difference between products by subject and bypanel and the data can be converted to ranks as well, which yields productpreferences. An example of the scale is given below.

Likeextremely 9

Likevery much 8

Likemoderately 7

Likeslightly 6

Neitherliked nor disliked 5

Dislikeslightly 4

Dislikemoderately 3

Dislikevery much 2

Dislikeextremely 1

Thesubject task is to circle the term that best represents their attitude aboutthe product. The responses are converted to numerical values for computationalpurposes, e.g., like extremely 9; dislike extremely 1; in a 9-point scheme.

Thesensory acceptance test is a very cost – effective resources that has a majorrole to play in the development of successful product. Properly used, it canhave a significant impact on the growth and long term development of sensoryevaluation.

*****☺*****

Module 3. Fundamental Rules, Score Card and Sensory Taste

Lesson 13. Panel Selection, Screening and training of judges.

13.1. INTRODUCTION

Sensory evaluation of dairyproducts are required to provide information in relation to: productimprovement, quality maintenance, new product development and market analysis. Ingeneral, following three purposes are suitable for lab panels / highly trainedexperts

1. Select qualifiedjudges and study human perception of food attributes.

2. Correlatesensory with chemical and physical measurement.

3. Study processingeffects, maintain quality, evaluate raw materials, establish storage stabilityor reduce cost.

For Largeconsumer groups, following purposes are most suitable

1.Evaluate quality

2.Determine consumer preference.

Lab panels areof following types:

l. Those which determine simpledifferences between treated samples, and

2.Those which determine directionaldifferences.

13.2. TESTS FOR PANLE SELECTION

13.2.1. Difference tests:

The tests which are used for panel selection include:

1. Single stimulus,

2. Paired stimuli.

3. Duo – trio and

4. Triangle and multi – sample tests.

Those testswhich do not reveal statistically significant differences between treatments. No further evaluation is needed. When differences are found, directionaldifference tests are used to establish the nature and magnitude of difference. After a significant difference has been established by a lab panel. Consumersmay be asked to express preference.

a. In generalSINGLE sample is used for consumer studies. In fact, in product like productsseveral samples are tested and compared, with previous established standard (MEMORY STANDARD). Occasionally a method called A is not A, is used, in which astandard A is presented first followed by one or more coded samples. This isclassified as PAIRED comparison.

b. PAIRED - STIMULI : In this test, judges have to specify two samples. This is used forcomparing new with old processing procedures in quality control and inpreference testing at the consumer level.

c. DUE – TRIO : Itis modified paired presentation in which one sample and is presented first,followed by two coded samples one of which is identical with standard. Thejudge has to identify which of the two is identical to the standard. Thisprocedure is used in quality control and for selection of judges of superiordiscrimination.

d. TRIANGLE test:\Twoidentical and one different samples are presented simultaneously and the judgeis asked to indicate the odd sample. Triangle test is also used to selectjudges.

13.2.2. Rank Order

Ranking is used to determine howseveral samples differ on the basis of a single property (i.e. sweetness) Agroup of coded samples (which may contain a standard) are presented and thejudges is asked to rank them in order of intensity of a specified property. This method is suitable for comparing sensitivity of panelists. This testuseful for lab judges in R & D work, experts for selecting the best sampleand consumer panels for relative acceptability

13.2.3. Other Methods

There are several other test / procedures linescoring, hedonic rating and acceptance or preference test, dilution test, threshold test etc available and can be use in panel selection depending on theobjective of the panel testing.

13.3. PANELSELECTION AND TESTING ENVIRONMENT

Analysis of sensory properties offoods involves the use of human subjects in the lab environment. Thesensitivity and reproducibility of the judge influences the validity ofresults. The environment under which the data has been obtained also influencesthe results.

13.3.1 Panel Selection

By selecting the most stable andsensitivity members and training them, one might expect to obtain a small butefficient panel. Selection is important since individuals differ in sensitivity, interest, motivation and ability to judge difference. Discriminating skills maynot be general; a good wine taste may not be a good judge of chocolates. Seldomis a judge equally proficient in tasting all qualities and all flavours offoods. The methods of selection include a preliminary training period designedto acquaint the tasters with the quality factor involved in the product to betested.

13.4. SCREENING PROCEDURE FOR SELECTION OF PANELMEMBERS.

In screening procedure for selection of panelmembers, following points are to be considered:

· Discriminatingdifferences between solutions or substances of known chemical composition.

· Ability to recognizeflavours and odours.

· Performance incomparison with other panel members or

· Ability todiscriminate different samples to be used later in the test.

13.4.1. Approach for Screening:

· use as test materialsthe same products which will be tested later

· prepare sampleswith variations that are likely to be encountered later

· adjust thedeficiencies so that most will be able to discriminate but some will fail

· use score cardsimilar to the ones that will be used later

· start with alarge number of candidates, with simple selection test

· screen on thebasis of relative achievement continuing until top ranking group of the desiredsize is reliably selected

· reject at eachstage those that are not reliable but select more than actually needed.

A person with previous experiencemight utilize some of the skills he has developed. He may be able to note anddetect differences which are not detected by inexperienced judges. He can oftendescribe the sensory impressions more fully and usually has a betterunderstanding of the terminology employed.

13.5. SENSITIVITY TESTS

For general panel selection the candidates can be eliminated on the basis oflack of sensitivity to the senses, attributes, because of poor memory, slowrecovery from stimulation and failure to understand the test. Sensitivity totaste or odour appears to be only one of the factors influencing discrimination.

13.5.1. Factors influencing sensitivity:

The most important factors which influencing insuccessful judging are interest, motivation, knowledge and comparison ofresults, adjustment to the test situation memory etc. The panel members shouldbe given as much information as possible on the purpose and need ofinvestigation – however when this information might influence his judgement itshould be with held. A rewards system for maintaining interest is frequentlyrecommended. This may take the form of special pay, time off, specialprivileges, providing refreshments after panel sessions etc.

13.5.2. Panel Size

The number of judges needed willvary according to the variability's of individuals and of the product. Theseare as under:

Table-13.1: Panel size

Institute of Food technologists (USA) recommends3 to 10 for *TRAINED*; 8-25 FOR *SEMI – TRAINED* and 80 – for UN-Trainedmembers in panel.

13.5.2. Training

Training should be distinguishedfrom experience. Training ------- steps which may be taken deliberately toincrease the effectiveness and the rate at which the individual assimilates newknowledge or new techniques. Training is directed towards getting panel membersto disregard their personal preferences. It might also be directed—to securerecognition of small differences. One of the important aims of training is toobtain homogeneity

of response. Sensitivity to basic tastes and odours increasesdue to training. Training helps judges learn to compare flavours and flavourstrengths in spite oftime lag between samples.

13.5.3. Environment

Control of environment factors andsamples is universally recognized for sensory evaluation of foods. The labshould be air-conditioned. well lighted comfortable seating and free fromdistractions/smoking and cosmetic odours. Judges should be provided comfortableseating, a separate receptacle for expectoration, water for oral rinsting andadequate space for the samples and score card. The facilities should bethoroughly cleaned after the judge leaves and the new one comes.

13.5.4. Time of the day

Tests should be arranged when thejudges feel their best. Generally a time of 10:15 to 11:45 AM and 3:00 PM havebeen recommended. No significance differences have been observed when the testswere conducted at 11 AM or 3 PM

13.5.5. Sample factors

Dairy products have very milk delicate flavours. Therefore, if interest can be maintained, panel members can evaluate ratherlarge number of samples per session particularly with bland or mild flavouredfood. Normally the number of samples should be restricted to 6.

13.5.6. Masking

Masking is required for intentional minimizingof colour taste or odour properties so that the differences between samples canbe evaluated with less interference from the variable which has been minimizedi.e. use coloured containers. coloured light etc.

13.5.7. Preparation

Thenormal procedure is to test the dairy product under conditions approximatelythe same as found under normal consumption: bread should be dry, butter solid, vegetables whole etc. Within a set of samples the standard should also bepresented as an unknown.

13.6. SERVING PROCEDURES:

The samples presented must be representative of lotand exactly alike. The factors which are to be considered include visualappearance, sample size, temperature, utensils, pouring, coding order, instructions and rinsing.

13.6.1. Appearance

The Samples should be the same inform, consistency colour and appearance.

13.6.2. Sample Size:

The volume/ quantity of sample should be providedsufficient to taste with confidence. Sufficient sample to give a feeling of MOUTHFULNESS is recommended (30 to 50 ml for 2 mouthfuls)

13.6.3. Temperature:

Uniformity of temperature is necessary. Milk shouldbe served at 15 º C, Cheese , butter , and ice cream

13.6.4. Utensils:

All samples should be served in thecontainers of the same size, shape and colour. The utensils should not impart ataste or odour to the samples. Samples should be placed in the container in auniform. / aesthetic manner.

13.6.5. Coding:

All samples presented should becoded to avoid giving information to the panel. Three digit random numbers areideal.

13.6.6. Order of serving

Usually the first sample is assumedto be standard against which the rest of the samples are rated. Ideally strongflavoured samples should be served last as they frequently over-sensitize thetaste buds and recovery is not quick.

13.7. INSTRUCITON TO JUDGES

It may not be necessary to giveinstructions to a trained panel but this is not true for all panels. The bestpractice seems to be to allow the judges to use his preferred method but thesame technique should be used by him.

*****☺*****

Module 4. Sensory Evaluation of milk

Lesson-14
Judging and Grading of Milk

14.1. INTRODUCTION

The sensory evaluation of milk is of utmost importance. Packaged and retail sale of fresh milk comprises a major share of Indian dairy industry (both in the organised and unorganised sectors). Since fluid milk is consumed by almost everyone, everyday it is being assessed daily for its quality. If the flavour of milk is not appealing or appetizing less of it will be consumed.

The sensory characteristics of any dairy product is dependent on the quality attributes of milk used. If the raw milk supply is properly assessed for its sensory quality, all off flavour defects due to raw milk could be minimized if not eliminated.

Among dairy product judges the scoring or differentiation of milk into different quality classes demands keener, more fully developed senses of smell and taste than in the sensory evaluation of other dairy products. Many of the off-flavours present in fluid milk are more delicate, less volatile or more elusive than those present in other milk products.

Milk, may be raw or pasteurized, skim or whole, toned or double toned, standardized or full-fat, cow or buffalo. In this lesson the term ‘milk’ would mean PASTEURIZED, STANDARDIZED (MIXED) MILK unless otherwise specified. Pasteurization is effected by heating the milk to 72°C for 15 sec and 63°C for 30 min in HTST and LTLT respectively.

PASTEURIZED milk commonly possesses some degree of a heated or cooked flavour especially immediately after processing, but the intensity of cooked flavour diminishes during storage. The flavour of milk is affected by:

Heating-up and cooling time

Temperature difference between the product and heating medium

Velocity of the product in a continuous system

Occurrence of product 'burn on', and

Direct vs. indirect heating methods.

The flavour of pasteurized unhomogenized milk undergoes flavour changes during storage as

below:

HEATED-> NORMAL-> FLAT -> METALLlC--> OXIDISED

The extent of flavour deterioration depends on the storage time, season of the year, type of roughage fed to the cow and buffaloes and relative levels of cupric or ferric ions.

14.2. MILK SCORE CARD

The original score card (100 point scale) developed by the ADSA has been extensively modified. The BIS score card for milk is given in Table 14.1. Familiarity with the score card and use of score card guide is important for milk product judging.

Table-14.1: BIS Score card for milk

Assign score for each sample for different characteristics.		
CHARACTERISTICS	**MAXIMUM SCORE**	**SAMPLE SCORE**
Colour & appearance	10	
Odour	20	
Flavour	40	
Body	30	

Indicate the degree of defects such as the following. Encircle the one applicable and deduct from appropriate attributes.

CHARACTERISTICS	**DEFECT**	**DEGREE OF DEFECT**		
		Suspicion	Slight	Pronounced
Colour & appearance	Suspended particles, filth, foreign matter, bloody	2	4	10
Odour	stale, acidic, abnormal	5	10	15
Flavour	Cooked, oxidized, rancid, metallic, neutralizer, feed, barny, cowy, flavour defects due to adulterants and other additives.	5	10	20
Body	Watery, ropy, curdy	5	10	20

Table-14.2. Suggested scoring guide for flavour for milk

	Intensity of flavour defect				
	Slight	Moderate	Definite	Strong	Pronounced
Astringent	8	7	6	-	-
Barny	5	4	3	2	1-0
Bitter	5	4	3	2	1-0
Cooked	9	8	7	6	5-0
Cowy	6	5	4	3	2-0
Feed	9	8	7	6	5-0
Fermented/fruity	3	2	1	0	0
Flat	9	8	7	-	-
Foreign	3	2	1	0	0
Garlic/onion	5	4	3	2	1-0
High acid	3	2	1	0	0
Lacks freshness	8	7	6	0	0
Malty	5	4	3	2	1-0
Metallic	5	4	3	2	1-0
Oxidised					
Light induced	6	5	4	3	2-0
Metal induced	5	4	3	2	1-0
Rancid	4	3	2	1	0
Salty	8	7	6	5	4-0
Unclean	3	2	1	0	0

(Source IS: 7768-1975)

14.3. GRADING

After computation of data the following grades should be awarded. Any attribute showing pronounced defect should be graded poor and rejected

Quality of milk	Scores obtained	Grade of milk
Excellent	90 and above	A
Good	80 to 89	B
Fair	60 to 79	C
Poor	59 and below	D

14.4. MILK SCORING TECHNIQUES

14.4.1. Preparation of samples for evaluation

This depends on the purpose or objective of evaluation, number of participants and the quality criteria to be assessed. If several persons are to judge the milk samples for flavour, container and closure and other criteria then several containers of each individual lot of milk must be provided.

14.4.2. Order of examination and scoring

a) Closure

Closure should be carefully observed. Nowadays bottles or cartons (not used in India) are not the usual packaging material. The milk is being packaged in polyethylene sachets. Hence the evaluator must see that the packaging properly sealed to prevent leakage/pilferage.

b) Container

Container as stated above, since plastic bags are now in vogue; these should be examined for extent of fullness, cleanliness and freedom from cuts/nicks/pinholes from leakage.

c) Evaluation of milk flavour

The milk should be properly tempered between 13 to 18°C preferably 15.5˚C. Milk samples should be poured into clean, odourless glasses paper/plastic cups. 10 to 15 ml milk should be poured and a sip taken, rolled around the mouth and flavour sensation noted and then expectorated. Sometimes, any aftertaste may be enhanced by drawing a breath of fresh air very slowly through the mouth and then exhaling through the nose slowly. A full WHIFF of air should be taken soon after the sample is placed in the container for any off-odour that may be present.

Typically the flavour of milk should be "PLEASANTLY SWEET AND POSSESS NEITHER A FORETASTE NOR AN AFTERTASTE" other then that imparted by the natural richness due to milk fat and milk solids. When milk clearly exhibits the so-called TASTE there is usually something WRONG with the flavour of the milk sample. Thus milk is considered to have a defect if it has an odour, fore or after-taste and does not leave the mouth in clean, sweet pleasant condition following tasting. The scoring guide lists most frequently observed off-flavours. The defects should be described while scoring.

14.4.4. Undesirable flavours

a) Acid: Sour detected by taste and smell-due to microbial conversion of lactose to lactic acid which imparts a tingling effect.

b) **Astringent:** Not common in milk

c) Barny: Transmitted off- flavour due to poor ventilation, foul smelling environment. Perceived by sniffing and tasting. Characteristic aftertaste.

d) Bitter: Associated with other defects like astringency, rancidity due to weeds and microbial (psychrotrophs) growth.

e) Cooked: Heat-induced. Appears when milk is heated to 76°C or more. There are 4 types of heat-induced flavours: COOKED/SULPHUROUS; HEATED OR RICH; CARAMELISED and SCORCHED. Heated and cooked flavours are easily identified, reaction time is quick, sensation remains after expectoration. Cooked flavour may also be noted through smell.

f) Cowy (acetone): Distinct, persistent unpleasant, medicinal chemical aftertaste with acetone bodies in milk i.e. ketosis in cows.

g) Feed: Imparts aromatic taints to milk when fed ½ - 3 h prior to milking. The off-flavour is aromatic sometimes pleasant (e.g. alfa-alfa), detected by smell varies with feed. To prevent such feeds should not be fed 3 h prior to milking.

h) Fermented/Fruity: Resembles vinegar, pineapple and apple. Found in old pasteurized milk, due to growth of Pseudomonas spp. (*P. fragii*).

Flat: Bland in taste, lacks mouthfeel and lacks sweetness

j) Foreign: Can be detected by smell or taste due to chemicals/detergents, disinfectants, sanitizers, exposure to fumes of petrol, diesel, kerosene, insecticides, ointments, medication to cows etc.

k) Garlic/Onion (weedy): Pungent odour and persistent aftertaste.

l) Lacks freshness (stale): Taste reaction indicates loss of fine pleasing taste, slightly chalky. May be 'forerunner' of either oxidised or rancid off-flavour or off-flavour caused by psychrotrophs.

m) Malty: Flavour definite or pronounced, suggestive of malt caused by the growth of *S. lactis var maltigenes* at > 18.2°C for 2-3 h can be smelled or tasted. Bacterial population in millions, followed by acid/sour taste.

n) Metal-induced oxidised off- flavour: Due to lipid oxidation-metal catalyzed. Metallic, oily, cardboardy, happy, stale, tallowy, painty and fishy are used to describe this off-flavour. The off-flavour is quickly perceived in the mouth and has a relatively short adaptation time.

o) Light-induced oxidized off-flavour: Described as burnt, burnt protein, burnt feathers, cabbagy, medicinal or chemical-like, light-activated or sunlight flavour or sunshine flavour, light catalyzed lipid oxidation as well as protein degradation both are involved. It requires riboflavin which is naturally present in milk. Homogenized milk is more susceptible but is resistant to oxidized off-flavour (due to lipid oxidation) the opposite is true for non-homogenized milk.

p) Rancid: Extremely unpleasant, due to volatile fatty acids formed through enzymatic hydrolysis of fat. Soapy, bitter and unclean aftertaste. Flavour is nauseating and revolting.

q) Salty: Perceived quickly in the mouth

r) Unclean: Due to the growth/ activity of psychrotrophs at >7.2 ° C.

*****☺*****

Module 5. Fermented milk and milk proudts

Lesson 15. Desirable and undesirable characteristics of fermented milks, sensory evaluation of dahi, yoghurt, chakka, shrikhand, lassi and other fermented drinks.

15.1. INTRODUCTION

Dahi and yoghurt are categorized as acidfermented milk products. Dahi is indigenous fermented milk, which is preparedby the lactic acid fermentation of milk. Yoghurt is the exotic counterpart ofdahi, which is prepared by using cultures containing Lactobacillus bulgaricusand Streptococcus thermophilus. Though dahi and yoghurt are well knownfermented dairy products, literature on their sensory evaluation is notavailable. The BIS has specified standards for dahi, but not covered thesensory quality requirements. Hence an attempt has been made to evolve ascorecard for sensory evaluation of dahi and yoghurt.

Broadly speaking dahi meant for directconsumption falls in to 3 categories viz. (i) sweet dahi, (ii) sour dahi and(iii) sweetened dahi. The dahi may be prepared from either whole milk or skimmilk. The production of dahi involves boiling of milk followed by cooling toroom temperature. The milk is then inoculated with starter and then allowed toset overnight without disturbance. The curd will generally set in a period of 6to 8 hours.

15.2. Desirable characteristics in Dahi

15.2.1. Colour and Appearance : The colour of dahi should be pleasing,attractive and uniform without showing any signs of visible foreign matter. Thecolour of dahi ranges from creamish yellow for cow to creamish white forbuffalo milk. It should be free from browning. Dahi should have smooth andglossy surface without appearance of any free whey on top.

15.2.2. Flavour : Flavour of dahi is the most importantquality attribute. A pleasant sweetish aroma and a mild clean acid taste arelooked for in the product. It should be free from any off flavour. A goodpleasant diacety1 flavour is desired in dahi. Skim milk dahi lacks the naturalrich flavour of fat. Dahi should not show any signs of bitterness, saltiness orother off flavours.

15.2.3. Body and Texture : Good dahi is a weak gel like junket, whenwhole milk is used. It has a creamy layer on top, the rest being made up of ahomogeneous body of curd. The surface should be smooth and glossy while the cutsurface is trim and free from cracks and gas bubbles.

15.2.4. Acidity: Generally an acidity of 0.75 to 0.85 % lacticacid is appropriate for good dahi. Excessive acidity gives the product a sour, biting taste. However in sour dahi, the acidity can go up to 1 %.

15.3. Scorecardfor Dahi:

Onthe basis of desirable attributes for good dahi, the following score card issuggested.

Table-15.1: Scorecard for Dahi

Table-15.2: Scores for degree of defects

15.4. Sequence of Observations:

For judging the quality of dahi thefollowing observations have to be made in the order specified below:

1. Container:

Note the type and condition of containerand presence of any package defects. Observe for the fullness, cleanliness andgeneral appearance.

Note any soiling of container or lid.

2. Aroma:

Remove the closure of the package andobserve the typical aroma by smelling the product immediately.

Notice the intensity and duration of aroma.

3. Colour& Appearance:

Examine for uniformity of colour and thepresence of any visible foreign matter. The surface of dahi should be shining.

4. Body& Texture:

Cut the curd by means of a spoon Knife andlift a portion of it.

Observe the evenness of cutting.

Observe the cut surface for any air pocketsor free whey pockets.

5. Flavour:

Place a small spoonful of curd on thetongue and observe the flavour and aroma for both intensity and duration.

Note the type of taste perceived.

Expectorate the sample and note the aftertaste.

15.5. Defects in Dahi:

15.5.1. Colour and Appearance:

Normally good quality dahi will not showany objectionable colour defect or, appearance defect. However, a brown colourdue to over boiling of milk will usually result and is considered a defect. Ifthe milk is not strained, foreign matter appears on the top layer of dahigiving unclean appearance. Surface discoloration due to growth of moulds is notcommon, however, after prolonged storage this defect is likely to beencountered. Free whey floating on the surface is a serious defect.

15.5.2. Flavour:

15.5.3. High acid: This defect iscaused either due to excessive amount of inoculums, or high temperature orprolonged storage, and is characterized by sharp taste and very acidic smell.However, in sour dahi high acid level (1 %) is not considered as a defect.

15.5.4. Bitter: Generallyassociated with contamination of milk or culture with sweet curdling organisms.Sometimes bitter taste is also associated with milk from animals fed on certainfeeds. Bitter taste is generally perceived at the end of tasting period

15.5.5. Cheesy: This defect isnoticed in dahi stored for a long period and due to proteolysis of milk.However, this defect is not common in dahi as it is generally not stored forlong time.

15.5.6. Metallic: This defect isdue to contamination of milk with iron or copper and occurs when curd is set inmetallic containers. The sour taste of dal1i masks the metallic defect.

15.5.7. Lumpy or grainy: This defect is observed more often when reconstituted milk is used, and is dueto improper dissolution of milk powder. This is not a common defect.

15.5.8. Watery with Curdy flakes :This defect arises from low total solids content followed by mechanical stressto curd.

15.5.9. Wheying off: This is a serious defect noticed in dahi. Free whey floats either on the top orcurd floats on top with free whey at the bottom. Free whey appearance at thetop is associated with high acidity, higher temperature and prolonged storage.Appearance of whey at bottom with curd floating on the top gives an indicationof contamination of either milk or starter.

15.5.10. Too weak body : Inthis case dahi will not retain its body and flows like condensed milk from thecontainer. This defect may be due to either low total solid content (adulterationwith water) or insufficient acid production

15.5.11. Gassy: Presence of gaspockets in the body of curd or gassy appearance is a serious defect associatedwith the growth of contaminant yeasts or coli aerogenes organisms.

15.5.12. Ropiness: This defect isnot generally associated with dahi, but can be seen if milk is not pasteurizedproperly or gets contaminated with sliminess producing organisms.

15.6. Yoghurt

15.6.1. Desirable characteristics of Yoghurt:

15.6.1.1. Appearance and colour:

Yoghurt appears as a jelly like coagulumand with porcelain like surface without wheying off the coagulum cuts to give aclean surface. Yoghurt should not contain any foreign matter except flavorings(added to the flavoured yoghurt). However, stirred Yoghurt should be homogenousand give sufficiently stirred appearance. In natural Yoghurt natural milkcolour should be present. Yoghurt should have fresh appearance.

15.6.1.2. Body and Texture:

The body of yoghurt should be custard likewith smooth texture. Adequate firmness without syneresis is essential for a topquality product. Stirred yoghurt should be creamy, viscous and non-pasty.

15.6.1.3. Flavour:

Natural yoghurt should have a pleasantlymilk to light sourish taste with natural yoghurt flavour. In case of flavoured yoghurt, the flavour should be typical for the flavouring used.

15.6.1.4. Acidity:

Normally 0.8 to 1.0% lactic acid is desiredin yoghurt.

15.6.2. Sequence of observations:

Follow the same sequence of observations asfor dahi.

15.7. Defects in Yoghurt:

15.7.1. Appearance and Colour:

The possible defects include presence ofextraneous matter, lack of uniformity, unnatural colour (colour not typical ofthe flavouring in case of flavoured yoghurt), surface discolouration, wheyingoff, fat separation, gassiness and improper distribution of additions likefruits and flavorings.

15.7.2. Flavour

The flavour defects in yoghurt are

• Metallic, oily, tallowy and rancidflavour arising from oxidation or rancidity of milk fat

• Cheesy, bitter and putrid flavourassociated with proteolysis

• High acid and too sour resulting fromover fermentation

• Stale and flat flavour due to lack ofspecific aroma

• Too low and too high flavour inartificially flavoured yoghurt

• Feed flavour arising from the milk

• Yeasts, fruity and malty flavoursassociated with the growth of contaminants

• Burnt flavour resulting from overheatingof milk

15.7.3. Body and Texture:

These include

• Thin and milky body due to lack offirmness of gel arising from low solids content and insufficientincubation

• Split body which is a consequence ofshaking the gel by faulty handling

• Granular or lumpy: a defect noted withimproper dissolution of milk powder and also a defect inmicrostructure due to very slow acidification by the starter

• Whey separation arising from thesyneresis of the gel, which may be a result of high acid

formation or lowsolids concentration

• Sticky, gluey, gummy and too firm body asa result of excessive addition of stabilizers

•Ropinessassociated with ropy fermentation

•Weak body resulting as a consequence oflow level of fermentation coupled with low total solid concentration

•Presence of gas holes due to contaminationwith yeasts and coli aerogenes group of organisms

Table-15.1: Scorecard for yoghurt/Dahi

Suggested scorecard for yoghurt/Dahi

Table-15.2: Scorecard for degree of defects yoghurt/Dahi

*****☺*****

Module 6. Fermented milk and milk products

Lesson 16. Desirable and undesirable characteristics of fermented milks, sensory evaluation of chakka, shrikhand, lassi and other fermented drinks

16.1. INTRODUCTION

Shrikhand is a semi-solid, sweetish-sour, wholesome, indigenous fermented milk product of western India. It is preparedby : (a) curdling of milk and/or skim milk using lactic starter culture toobtain dahi, (b) draining most of the whey from dahi to get chakka; either bysuspending it in muslin cloth bag or by mechanical means such as basketcentrifuge or continuous curd separator, (c) addition of sugar flavouringand/or cream (80% fat) in case of skim milk chhaka, (d) kneading togethermanually or in a planetary mixer to obtain homogeneous consistency, (e) mixingof other additives such as fruits, nuts, colour etc. if desired and (f) coolingit to a low temperature before (less than 10 C) it is ready for consumption.

On the basis of organoleptic evaluation, most desirable Shrikhand should have 5-6 % milk fat, 38-40 % moisture, 40-45 %sugar and 1.0-1.1 % lactic acidity. The flavour of Shrikhand is greatlyinfluenced by the level of the developed acidity at which curd is converted tochhaka and chhaka in its turn to shrikhand. The typical consistency ofshrikhand is influenced to a great extent by the moisture, fat and sugar levelsin the product. The last two factors also have an influence on flavour.

16.2. DESIRABLE SENSORY QUALITY OF SHRIKHAND

16.2.1. Appearance of the container: Desirably in good condition i. e. itshould be properly sealed with surface showing no soiling.

16.2.2. Product appearance & colour: It shall be free from signs of free fator syrup separation or both and uneven colour distribution.

16.2.3. Flavour: It shall have a clean, pleasant, sweetish-sour flavour, representing blend of added sugar and of fermented milksolids. It should be free from objectionable flavours and odours.

16.2.4. Texture and consistency: It shall have a typical semi-solid, uniform consistency showing a characteristic firmness and pliability and shallshow smooth texture without any sign of graininess.

16.2.5. Temperature and acidity of theproduct: Desirably theproduct may be consumed or evaluated at a low temperature of about 10 C. Itshall have optimum acidity around 1.0 -1.1 % expressed as lactic acid.

16.3. Sensoryrequirements for Chakka:

16.3.1. Appearance and Colour: Chakka when properly made should be free from anysigns of fat or water seepage or both and moldiness. It shall be white to paleyellow and no extraneous colour shall be added.

16.3.2. Odour and Flavour: Chakka shall have pleasant yoghurt (dahi) likeflavour. I shall be free from objectionable flavours and odours.

16.3.3. Texture and Consistency: Chakka shall be of good texture and consistency. Itshall be free from coarseness. It should be manufactured and packed inequipment and premises maintained under hygienic conditions. It shall also bestored and distributed under hygienic conditions.

16.4. How to evaluate the Product?

Preferably in a well-furnished sensorylaboratory trained judges judge shrikhand for its quality. Usually panel of 6-8 persons is selected on the basis of duo-trio test. For preference testing (involving actual consumers) the panelists may be asked to judge theintensities or to specify in some way their preferences using the nine-pointhedonic scale.

For discriminating testing, highly trainedevaluators are provided with score card indicting the maximum and minimum scorefor each of the sensory attributes of the product, along with the suggestedscore deductions for defective samples is expected to help the judge in properorganoleptic evaluation. As far as possible not more than six samples should beserved at a time for the evaluation.

16.4.1. Procedure:

Place the shrikhand container on a table ora platform and examine it for the appearance.

Cut open and inhale its aroma, note thesurface of the content and the temperature and also evaluate its colour andappearance.

Pick-up a spoonful of the product and allowit to drop back noting its consistency, body, firmness and falling behavior ofthe product.

Take the product into the mouth and noteit's tactual and taste sensation. Judge the product for its smoothness anduniformity by swallowing the secondary taste reaction, the taste beyond sweetand sour, will have been experienced, expectorate the sample and register if anafter taste persists.

In order that the sensory panelists aremade aware of the desirable and undesirable characteristics of shrikhand, theyheed to be exposed to various types of shrikhand and trained to identity goodquality product.

Training is very vital in the successful adoption of sensoryevaluation as an instrument of quality control. For accurate judging andgrading it is necessary that the judge has the awareness of different defectsand their intensities. This would enable him to identify and discriminateagainst a defective product.

Some of the **commondefects observed in shrikhand** can be simulated as given below:

Table-16.1: Common defects observed inshrikhand

Table-16.2: Sensory evaluation card for shrikhand

Table-16.3: Suggested score deductions for shrikhand

For computing the final score - total for allattributes, the products may be assigned a suitable grade as shown below:

Table-16.4: Score card for shrikhand

Module 5. Fermented milk and milk products

Lesson 17. Sensory Attributes of Fresh Cheese

17.1. INTRODUCTION

Softunripened cheeses are commonly known as "Fresh Cheese" and are madeby coagulating the whole milk, partly skimmed milk, skim milk or cream; eliminating a large part of the liquid portion (whey) and retaining thecoagulated milk solids. The amount of water retained in the curd greatlyinfluences the relative softness of unripened cheese made from milkhaving/constant casein-to-fat ratio. Softness of cheese also depends on theextent of protein hydrolysis salt content and the amount of milk fat in cheese. Soft unripened cheese derives their flavour mainly from the culture and thecream dressing. Cottage cheese, cream cheese, Mozzarella cheese, Ricotta cheeseetc. are some of the common varieties of fresh cheese. They differ from eachother in their method of manufacture with respect to type of milk, treatmentgiven to milk, type of culture, amount of culture, method of coagulation, cutting of curd, cooking of curd, pressing of curd etc.

Consequently, they differ in sensory as well as chemical attributes. The desirable sensoryattributes of fresh cheeses, defects and their probable causes and remedieswith special reference to cottage cheese are described in this lecture note.

17.2. Cottage cheese

Cottagecheese is a fresh, soft, unripened cheese made from sweet, pasteurized skimmilk by lactic culture with or without the addition of rennet. The curd is cutand cooked to facilitate whey expulsion and development of proper curdconsistency. 'When the curd has attained the desired consistency, whey isdrained off, curd is washed and salted. Subsequently, the curd is dressed withcream in the case of creamed cottage cheese which contains 4% fat. Cottagecheese contains 80% moisture. The cheese is consumed whole fresh; consequently, the flavour of the product depends on the quality of skim milk, and the culturefrom which it is made.

Table-17.1: Score Card for CottageCheese

Score Card for Cottage Cheese	
Flavour	45
Body and Texture	30
Appearance and Colour	20
Colour	05
Total	100

17.3. Desired sensory attributes

17.3.1. Appearance and colour

Thecurd particles of cottage cheese should be distinctly separate and uniform insize and shape. The cheese should possess moderately glossy sheen and creamywhite colour. The cream dressing should be reasonably viscous and foam free, and bulk of it should adhere to the curd particles. The excess dressing shouldform only a uniform and smooth coating on the curd particles.

Freecream, free whey, lack of uniformity and the presence of lumps or curd dust areconsidered as common appearance defects in cottage cheese ca used· mostly byfaulty method of manufacture viz., excessive cooking, insufficient washing,cutting of curd at too high or too low pH, rapid cooking, uneven cutting orcutting with a

faulty knife or aggressive stirring low TS milk, excessive heattreatment of skim milk, use of excessive coagulator, severe stirring or roughhandling of curd during cooking etc. Appropriate corrective measures duringmanufacture of cottage cheese eliminate these defects.

17.3.2. Body and texture of cottagecheese

Ideally, creamed cottage cheese should have a tender body and smooth and meat liketexture. Curd particles should maintain their shape and individual identity butshould not be too firm, rubbery or too soft. Smooth, meaty and tender curdparticles exhibit good capillary desired for complete absorption of creamdressing.

17.4. Body &Texture defects

17.4.1. Too firm body: Firm or rubbery bodied curd panicles of cottage cheese resist crushing betweentongue and roof of the mouth. This defect occurs due to over use of rennet orother milk coagulator; cooking of curd at too high temperature and for too long; or cutting of curd at a pH more than 4.7

17.4.2. Mealy/Grainy/Gritty: Presence of this defect gives a corn meal like sensation in the mouth whenmasticated curd is pressed by the tongue against the roof. Also a dry rough andserrated curd mass is observed when the washed curd particles of creamedcottage cheese are kneaded and smeared between the forefinger and thumb. Thedefect may be caused by overdeveloping the acid during curd formation; retention of too low moisture, non-uniform cutting of coagulum, uneven heating,too rapid cooking, in.1dequate stirring, and curd particles coming in contactmilk extremely hot surfaces during cooking.

17.4.3. Gelatinous: Gelatinous cheese has a jelly-like and sticky character. Often this defect isassociated with a bitter flavour and translucent appearance. This defect iscaused by psychotropic bacteria.

17.4.5. Weak/soft/mushy: This defect is characteristic of high moisture, low-solid cottage cheese. It iscaused by faulty manufacturing methods which flavour retention of whey in thecurd. On storage such cheese may become pasty and bitter.

17.4.6. Over stabilized dressing: When this defect occurs the creamed cottage cheese appears dry and someindividual curd particles are surrounded by a thick, pasty, coating. This isusually happens due to the use of excessive amount of non-fat dry milk, stabilizers and or emulsifiers.

17.5. FLAVOUR

Cottagecheese should have a fresh, clean, pleasant delicate (balanced culture) flavourthat cleans up well immediately after the sample has been eliminated from themouth. This flavour is made up of characteristic curd flavour and its acidity, volatile products by lactic acid organisms. Addition of cream and salt enhancethe flavour of creamed cottage cheese.

Theprobable Cottage cheese being highly perishable product is prove to thedevelopment of specific flavour defects as

17.5.1. Acid/ high acid/sour: Acid taste is clean and sharp while sour taste is pronounced and may beassociated with other bacterial defects like fruity, fermented etc. Excessiveacid development and/or insufficient washings of the curd cause this defect. Such product is sometimes also criticized for flavour defect like "wheytaint".

17.5.2. Bitter: Bitter flavour is characterized by its relatively slow reaction time; taste ator near the back of the tongue only; freedom from astringency; and persistenceafter expectorating the sample. The defect is most frequently encountered inold cottage cheese or in the sample stored at a temperature favourable for thegrowth of pseudomonas organisms.

17.5.3. Flat: Absence of characteristic flavour or aroma is termed as f11t flavour. A dry, unsalted and washed rennet curd yields a distinctly flat taste during theintermediary stages of oxidized flavour development.

17.5.4. Lacks freshness: The flavour of cottage cheese is its best immediately after manufacture. Cottage cheese progressively deteriorates in flavour during storage. Often thisdefect is referred as storage flavour because the aroma of cheese is similar tothat of the refrigerator in which it was stored.

17.5.5. Fruity/ Fermented: This defect ischaracterized by the presence of a pleasant aromatic flavour suggestive of pineapple, apple, banana or strawberry and distinctive lingering aftertaste. Thecottage cheese stored at elevated or favourable temperatures for thepsychrotrophic bacteria may develop this defect.

17.5.6. Yeasty: Yeasty and vinegar likeflavours have a peculiar aromatic quality in addition to high acidity. Yeastsand various other contaminants including psychrotrophic bacteria are generallyresponsible for causing this flavour defect.

Otherflavour defects in cottage cheese include malty, musty. oxidized, rancid, saltyand unclean flavours.

17.6. Cream cheese

Creamcheese is a soft, unripened cheese made by coagulating cream (12-30% milk fat) either by lactic acid bacteria aided by milk coagulating enzymes or by directacidification followed by removal of whey by centrifugation or pressing thecurd in cloth hags. The fat content in the final product varies from 3 to 40%. Neufchatel cheese is a similar product made from whole milk of high fatcontents. It contains about 20-25% fat.

17.6.1. Desirable sensoryattributes

17.6.1.1. Flavour

Creamcheese should have a full rich, clean and mild acidic flavour. Neufchatel typecheese may have a moderate acid taste. More common flavour defects in varioustypes of cream cheese may be flat, sour or too high acid, metallic, yeasty andunclean after taste.

17.6.1.2. Body and texture

Softyet sufficiently firm body to retain its shape is the characteristic of creamcheese. The texture should be somewhat buttery and silky smooth. It shouldpossess both spreading as well as slicing characteristics. Cream cheeseprepared from cream containing 16% fat exhibits most desirable body and textureproperties. In such cheeses the moisture and fact content may vary in theranges of 50-54~/o and 37-42%, respectively. Cream containing less fat yields acream cheese which is criticized as having grainy texture and crumbly body. Increased fat content of cream (20%) results in excessive smoothness andstickiness. Other body and texture defects of cream cheese include coarse, grainy, too firm and too soft.

17.7. Mozzarella cheese

Itis a soft unripened variety of cheese of Italian origin. It is produced fromwhole or partly skimmed milk to which small amounts of starter or organic acidsare added, followed by rennet extract. The curd is cut allowed to firm up inthe warm whey with occasional stirring and the whey is drained off. When thecurd has developed the desired plasticity and fibrous texture and the wheyacidity 0.65 - 0.70% LA, it is milded. The curd pieces are immersed in hotwater kneaded, stretched and moulded. Salting of cheese is done by dipping thecheese in· brine solution for few days. The cheese can be consumed after thebrim: treatment is complete.

17.7.1. Desirable sensoryattributes

17.7.1.1. Colour and appearance

Mozzarellacheese should have a uniform white to light cream colour. Faulty manufacturingmethod and microbial contamination may sometimes cause colour defects in theproduct. Use of too high salt may cause discoloration. Development of browningmay be caused by using starter culture containing only thermophilus. Contamination with Pseudomonas species causes development of superficialreddish marks.

17.7.1.2. Body and texture

Mozzarellacheese should have a soft, elastic, waxy and moist body with typical structureof pulled curd cheese. It should have a fibrous texture with no gas holes. Itshould possess a good slicing as well as melting properties. Use of too highsalt or growth of Lactobacillus caseimay cause poor melting quality. Undesirable microbial contamination may causedevelopment of defects, like pigmentation, hole formation and other texturaldefects. Rapid evaporation of moisture from the surface leads to thedevelopment of granular texture.

17.7.1.3. Flavour

Bland, pleasant but mildly acidic with slightly salty taste is the characteristic ofmozzarella cheese. Buffalomilk cheese is a more piquant and aromatic than cow milk cheese. Microbialcontamination, particularly with Pseudomonas species may lead to thedevelopment of flavour defects like putrid smell, bitter flavour etc. Otherflavour defects may be of absorbed or chemical nature as in the case of cottagecheese.

17.8. Ricotta cheese

Itis yet another variety of soft unripened cheese of Italian origin. In themanufacture of ricotta cheese, mixture of whey and skim milk is acidified to acritical pH with lactic acid, acetic acid or acid whey powder and then heated. The resulting curd is recovered and over filled in perforated tin containers, cooled and allowed to drain free whey. Cheese is now ready for consumption. Ricotta cheese made from whole milk is consumed directly while made from skimmilk or whey skim milk mixture is highly suited for pastry manufacture.

Ricottacheese from whole milk resembles highly creamed cottage cheese but has a softerand more fragile texture. A mixture of skim milk whey yields a firmer and drierproduct which lacks its distinctive nutty flavour. In general ricotta cheese issoft and creamy with a delicate, pleasant and slight caramel flavour.

Ricotta cheese is highly susceptible to spoilagedue to microbial contamination leading to flavour defects like sour, fermented, fruity etc. Excessive gas formation may also cause blowing of the lid of thecontainer.

17.1. INTRODUCTION

Softunripened cheeses are commonly known as "Fresh Cheese" and are madeby coagulating the whole milk, partly skimmed milk, skim milk or cream; eliminating a large part of the liquid portion (whey) and retaining thecoagulated milk solids. The amount of water retained in the curd greatlyinfluences the relative softness of unripened cheese made from milkhaving/constant casein-to-fat ratio. Softness of cheese also depends on theextent of protein hydrolysis salt content and the amount of milk fat in cheese. Soft unripened cheese derives their flavour mainly from the culture and thecream dressing. Cottage cheese, cream cheese, Mozzarella cheese, Ricotta cheeseetc. are some of the common varieties of fresh cheese. They differ from eachother in their method of manufacture with respect to type of milk, treatmentgiven to milk, type of culture, amount of culture, method of coagulation, cutting of curd, cooking of curd, pressing of curd etc.

Consequently, they differ in sensory as well as chemical attributes. The desirable sensoryattributes of fresh cheeses, defects and their probable causes and remedieswith special reference to cottage cheese are described in this lecture note.

17.2. Cottage cheese

Cottagecheese is a fresh, soft, unripened cheese made from sweet, pasteurized skimmilk by lactic culture with or without the addition of rennet. The curd is cutand cooked to facilitate whey expulsion and development of proper curdconsistency. 'When the curd has attained the desired consistency, whey isdrained off, curd is washed and salted. Subsequently, the curd is dressed withcream in the case of creamed cottage cheese which contains 4% fat. Cottagecheese contains 80% moisture. The cheese is consumed whole fresh; consequently, the flavour of the product depends on the quality of skim milk, and the culturefrom which it is made.

Table-17.1: Score Card for Cottage Cheese

17.3. Desired sensory attributes

17.3.1. Appearance and colour

Thecurd particles of cottage cheese should be distinctly separate and uniform insize and shape. The cheese should possess moderately glossy sheen and creamywhite colour. The cream dressing should be reasonably viscous and foam free, and bulk of it should adhere to the curd particles. The excess dressing shouldform only a uniform and smooth coating on the curd particles.

Freecream, free whey, lack of uniformity and the presence of lumps or curd dust areconsidered as common appearance defects in cottage cheese ca used· mostly byfaulty method of manufacture viz., excessive cooking, insufficient washing,cutting of curd at too high or too low pH, rapid cooking, uneven cutting orcutting with a faulty knife or aggressive stirring low TS milk, excessive heattreatment of skim milk, use of excessive coagulator, severe stirring or roughhandling of curd during cooking etc. Appropriate corrective measures duringmanufacture of cottage cheese eliminate these defects.

17.3.2. Body and texture of cottagecheese

Ideally, creamed cottage cheese should have a tender body and smooth and meat liketexture. Curd particles should maintain their shape and individual identity butshould not be too firm, rubbery or too soft. Smooth, meaty and tender curdparticles exhibit good capillary desired for complete absorption of creamdressing.

17.4. Body &Texture defects

17.4.1. Too firm body: Firm or rubbery bodied curd panicles of cottage cheese resist crushing betweentongue and roof of the mouth. This defect occurs due to over use of rennet orother milk coagulator; cooking of curd at too high temperature and for too long; or cutting of curd at a pH more than 4.7

17.4.2. Mealy/Grainy/Gritty: Presence of this defect gives a corn meal like sensation in the mouth whenmasticated curd is pressed by the tongue against the roof. Also a dry rough andserrated curd mass is observed when the washed curd particles of creamedcottage cheese are kneaded and smeared between the forefinger and thumb. Thedefect may be caused by overdeveloping the acid during curd formation; retention of too low moisture, non-uniform cutting of coagulum, uneven heating, too rapid cooking, in.1dequate stirring, and curd particles coming in contactmilk extremely hot surfaces during cooking.

17.4.3. Gelatinous: Gelatinous cheese has a jelly-like and sticky character. Often this defect isassociated with a bitter flavour and translucent appearance. This defect iscaused by psychotropic bacteria.

17.4.5. Weak/soft/mushy: This defect is characteristic of high moisture, low-solid cottage cheese. It iscaused by faulty manufacturing methods which flavour retention of whey in thecurd. On storage such cheese may become pasty and bitter.

17.4.6. Over stabilized dressing: When this defect occurs the creamed cottage cheese appears dry and someindividual curd particles are surrounded by a thick, pasty, coating. This isusually happens due to the use of excessive amount of non-fat dry milk, stabilizers and or emulsifiers.

17.5. FLAVOUR

Cottagecheese should have a fresh, clean, pleasant delicate (balanced culture) flavourthat cleans up well immediately after the sample has been eliminated from themouth. This flavour is made up of characteristic curd flavour and its acidity, volatile products by lactic acid organisms. Addition of cream and salt enhancethe flavour of creamed cottage cheese.

Theprobable Cottage cheese being highly perishable product is prove to thedevelopment of specific flavour defects as

17.5.1. Acid/ high acid/sour: Acid taste is clean and sharp while sour taste is pronounced and may beassociated with other bacterial defects like fruity, fermented etc. Excessiveacid development and/or insufficient washings of the curd cause this defect. Such product is sometimes also criticized for flavour defect like "wheytaint".

17.5.2. Bitter: Bitter flavour is characterized by its relatively slow reaction time; taste ator near the back of the tongue only; freedom from astringency; and persistenceafter expectorating the sample. The defect is most frequently encountered inold cottage cheese or in the sample stored at a temperature favourable for thegrowth of pseudomonas organisms.

17.5.3. Flat: Absence of characteristic flavour or aroma is termed as f11t flavour. A dry, unsalted and washed rennet curd yields a distinctly flat taste during theintermediary stages of oxidized flavour development.

17.5.4. Lacks freshness: The flavour of cottage cheese is its best immediately after manufacture. Cottage cheese progressively deteriorates in flavour during storage. Often thisdefect is referred as storage flavour because the aroma of cheese is similar tothat of the refrigerator in which it was stored.

17.5.5. Fruity/ Fermented: This defect ischaracterized by the presence of a pleasant aromatic flavour suggestive of pineapple, apple, banana or strawberry and distinctive lingering aftertaste. Thecottage cheese stored at elevated or favourable temperatures for thepsychrotrophic bacteria may develop this defect.

17.5.6. Yeasty: Yeasty and vinegar likeflavours have a peculiar aromatic quality in addition to high acidity. Yeastsand various other contaminants including psychrotrophic bacteria are generallyresponsible for causing this flavour defect.

Otherflavour defects in cottage cheese include malty, musty. oxidized, rancid, saltyand unclean flavours.

17.6. Cream cheese

Creamcheese is a soft, unripened cheese made by coagulating cream (12-30% milk fat) either by lactic acid bacteria aided by milk coagulating enzymes or by directacidification followed by removal of whey by centrifugation or pressing thecurd in cloth hags. The fat content in the final product varies from 3 to 40%. Neufchatel cheese is a similar product made from whole milk of high fatcontents. It contains about 20-25% fat.

17.6.1. Desirable sensoryattributes

17.6.1.1. Flavour

Creamcheese should have a full rich, clean and mild acidic flavour. Neufchatel typecheese may have a moderate acid taste. More common flavour defects in varioustypes of cream cheese may be flat, sour or too high acid, metallic, yeasty andunclean after taste.

17.6.1.2. Body and texture

Softyet sufficiently firm body to retain its shape is the characteristic of creamcheese. The texture should be somewhat buttery and silky smooth. It shouldpossess both spreading as well as slicing characteristics. Cream cheeseprepared from cream containing 16% fat exhibits most desirable body and textureproperties. In such cheeses the moisture and fact content may vary in theranges of 50-54~/o and 37-42%, respectively. Cream containing less fat yields acream cheese which is criticized as having grainy texture and crumbly body. Increased fat content of cream (20%) results in excessive smoothness andstickiness. Other body and texture defects of cream cheese include coarse, grainy, too firm and too soft.

17.7. Mozzarella cheese

Itis a soft unripened variety of cheese of Italian origin. It is produced fromwhole or partly skimmed milk to which small amounts of starter or organic acidsare added, followed by rennet extract. The curd is cut allowed to firm up inthe warm whey with occasional stirring and the whey is drained off. When thecurd has developed the desired plasticity and fibrous texture and the wheyacidity 0.65 - 0.70% LA, it is milded. The curd pieces are immersed in hotwater kneaded, stretched and moulded. Salting of cheese is done by dipping thecheese in· brine solution for few days. The cheese can be consumed after thebrim: treatment is complete.

17.7.1. Desirable sensoryattributes

17.7.1.1. Colour and appearance

Mozzarellacheese should have a uniform white to light cream colour. Faulty manufacturingmethod and microbial contamination may sometimes cause colour defects in theproduct. Use of too high salt may cause discoloration. Development of browningmay be caused by using starter culture containing only thermophilus. Contamination with Pseudomonas species causes development of superficialreddish marks.

17.7.1.2. Body and texture

Mozzarella cheese should have a soft, elastic, waxy and moist body with typical structure of pulled curd cheese. It should have a fibrous texture with no gas holes. It should possess a good slicing as well as melting properties. Use of too high salt or growth of Lactobacillus case may cause poor melting quality. Undesirable microbial contamination may cause development of defects, like pigmentation, hole formation and other textural defects. Rapid evaporation of moisture from the surface leads to the development of granular texture.

17.7.1.3. Flavour

Bland, pleasant but mildly acidic with slightly salty taste is the characteristic of mozzarella cheese. Buffalo milk cheese is a more piquant and aromatic than cow milk cheese. Microbial contamination, particularly with Pseudomonas species may lead to the development of flavour defects like putrid smell, bitter flavour etc. Other flavour defects may be of absorbed or chemical nature as in the case of cottage cheese.

17.8. Ricotta cheese

Itis yet another variety of soft unripened cheese of Italian origin. In the manufacture of ricotta cheese, mixture of whey and skim milk is acidified to acritical pH with lactic acid, acetic acid or acid whey powder and then heated. The resulting curd is recovered and over filled in perforated tin containers, cooled and allowed to drain free whey. Cheese is now ready for consumption. Ricotta cheese made from whole milk is consumed directly while made from skim milk or whey skim milk mixture is highly suited for pastry manufacture.

Ricotta cheese from whole milk resembles highly creamed cottage cheese but has a softer and more fragile texture. A mixture of skim milk whey yields a firmer and drier product which lacks its distinctive nutty flavour. In general ricotta cheese is soft and creamy with a delicate, pleasant and slight caramel flavour.

Ricotta cheese is highly susceptible to spoilage due to microbial contamination leading to flavour defects like sour, fermented, fruity etc. Excessive gas formation may also cause blowing of the lid of the container.

*****  *****

Module 5. Fermented milk and milk products

Lesson 18. Sensory Attributes of Ripened Cheese

18.1. INTRODUCTION

Cheddar cheese is one of the most common types of cheese produced in the world. It is generally made from flash heated or pasteurized milk to which about 1.0 percent lactic starter culture has been added. The curd formed by the addition of coagulating enzyme is finned by cooking at 39°C. The characteristic body of cheddar cheese is developed by a process of matting the curd known as cheddaring. The curd is pressed, paraffined and cured.

Mostly pasteurized milk cheddar cheese is marketed shortly after manufacture (<90days) as a mild cheese or for use in producing processed cheese. The ripening or curing of Cheddar cheese to develop characteristic cheddar flavour is as low, complex, bacteriological, chemical and enzymatic process which requires several months. Unripened or fresh or 'green' Cheddar cheese has a flat flavor and relatively tough, curdy or corky body. Cheddar cheese properly cured for at least 3 months or longer has a moderate, slightly nutty, cheddar flavour and is called "young" or "mild" cheese. At 6 to 8 months, more of the distinct, aromatic cheddar flavour should be evident; such cheese is considered as semi or medium aged. Generally, 8-10 months are required to develop the fully aromatic or robust ') Cheddar cheese flavour desired in an 'aged', or matured cheese.

18.2. Requirements for high quality cheddar cheese

18.2.1. Colour

It should always be uniform throughout the cheese, regardless of the chosen intensity.

Colour should also exhibit some luster. Cheese surface colour should be slightly translucent, i.e. It should appear as one could actually see into the cheese interior for a short distance. The translucent quality of cheddar cheese is closely associate d with desirable body and texture.

18.2.2. Common colour defects are

18.2.3. Finish and appearance:

Cheese with desirable finish should generally show symmetrically parallel ends; square even edges; evenly folded, neat, closed fitting plastic film or wrapper free from wrinkles, a clean, thin, uniform, closed adhering coating of paraffin (if used) showing no blister or scales; a freedom from pinholes, tears breaks, cracks, mold, rot spots, or soiled areas.

Table-18.1: Defects with cheese wrapped with various types of protective coverings

18.2.4. Body and texture:

Cheddar cheese with most desirable body and texture displays a full, solid, closed knit plug that possesses smoothness, meatiness, waxiness and silkiness, and is entirely free from gas holes or mechanical openings. Cheddar cheese with the above described quality attributes lends it to uniform slicing into thin, intact pieces.

Body of cheese refers to various physical attributes which primarily affect the relative firmness or softness of the cheese.

The term texture refers to the structure and arrangement of the various parts which make up the whole (the cheese unit) thus, texture in cheese is observed visually by the quantity: size: shape and distribution of openings and by the sense of touch (as in mealy/grainy) to uncover internal particles.

Table-18.2: More common body defects

18.2.5. Flavour

High quality cheddar cheese should possess the characteristic 'cheddar' flavour, which best described as clean, moderately aromatic, nutty like, and pleasantly acidic, while the same general flavour qualities are described in fresh, medium cured, and aged cheese, the intensity of characteristic cheddar flavour will primarily depend upon the extent of curing and actual curing condition.Usually, aged cheese has a sharp, aromatic intense flavour that is entirely lacking in young cheese. the flavour of high-quality cheddar cheese has been linked to that of the freshly roasted peanuts by various investigators.

Table-18.3: Possible flavour defects

The cheddar cheese score card

The quality of cheese is determined by comparing the properties or characteristics of each cheese with their accepted standards of perfection. For this purpose, as core card is used. The American Dairy Science Association has developed as core card for evaluating" Cheddar cheese.

Table-18.4: Score card for cheddar cheese

18.3. Tempering cheese

Beforeevaluation, cheese samples should be tempered at 10 °C to 15-5 °C for asufficient length of time to ensure uniform temperature throughout the cheese. This usually required 1-2 hrs for small blocks (up to 3 kg) and 3-5 h for largeones. Generally, a cheese plug taken from a warm cheese appears weak-bodied; bycontrast a cold plug may appear J brittle or corky.

18.4. Appearance

Typically, the first procedure in grading Cheddar cheese is visual examination of surfacefinish or packaging material. In general, the appearance should be clean, neat, attractive and symmetrical or the surface might be uneven, non parallel orrounded. The surface should also be free from holes, wrinkles and moulds.

18.5. Colour of Cheddar cheese

The evaluator should observe the colour of the cheese and determine whether the appearance is bright and clear or dull and lifeless. The colour of cheese should be uniform (free from mottled or light and dark portions) or whether there are curd scams or faded areas. The cheese plug appears to be translucent. Some of the colour defects associated with cheddar cheese is:

Acid-cut (bleached, faded), a typical colour specks, seamy (uneven wavy), colour too high (unnatural) and white specks.

18.6. Body and texture of cheddar cheese

Cheddar cheese with the most desirable body and texture displays a full, solid, close-knit plug that possesses smoothness, meatiness, waxiness and silkiness, andis entirely free from gas holes or mechanical openings. Such a product lends itself to uniform slicing into intact pieces. The common body defects are corky(dry, hard, tough),

crumbly (friable), curdy (rubbery), greasy, pasty (smeary, sticky, wet), short (flaky), spongy and weak/soft. The texture defects are mealy, gritty, slits, gassy, fissures and open (mechanical holes).

18.7. Flavour of Cheddar cheese

High quality Cheddar cheese should possess the characteristic "cheddar flavour", which is best described as clean, moderately aromatic, nutty like and pleasantly acidic while the same general flavour qualities are desired in fresh, medium-cured and aged cheese, the intensity of the characteristic cheddar flavour will primarily depend upon the extent of curing and actual curing condition. The flavour of high-quality Cheddar cheese has been likened to that of freshly roasted peanuts or hazelnuts by various investigators. Flavour defects in cheddar cheese could be listed as follows: High acid (sour), bitter, fruity, flat, garlic/onion (weedy), heated, malty, metallic, mouldy (rusty), rancid, unclean, yeasty etc.

18.8. Swiss cheese

Swiss cheese, also known as Emmental, Emmentaler, Schwaizer, or Sweitzer cheese, is a type of hard cheese made from clean, fresh milk. The specific manufacturing conditions are employed which differ widely from those for cheddar cheese. The utilization of thermophilic lactic bacteria and *Propionibacterium shermanii* for milk fermentation results in a cheese having flavour, body and texture and appearance characteristics peculiar unto itself. High-quality Swiss cheese is characterised by (i) a cream yellow colour (ii) a shiny surfaced round gas holes, and (ill) a characteristic" sweet hazelnut" flavour.

18.9. Requirements of quality Swiss cheese

18.9.1. Flavour

A good quality Swiss cheese should have a clean, distinctive, pleasing, sweet hazelnut flavour. Unique to this cheese variety, appropriate 'eye' formation in Swiss cheese is considered a good indication of typical Swiss cheese flavour. The common flavour defects found in Swiss cheese are as follows: flat, rancid, stinker, unclean, unnatural etc.

18.9.2. Eye development in Swiss cheese

The shape, size, and distribution of the "eyes" in Swiss cheese have an aesthetic appeal to consumers in addition to a possible association with typical Swiss cheese flavour. Round, symmetrical eyes are preferred in Swiss cheese, but a slightly elliptical or oval shape may be accepted without objection. The ideal frequency distribution of eyes in cheese tends to fadetowards the edge of the cheese block. The majority of eyes should be about i c min diameter. The defective cheese has too large eyes or numerous small eyes and sometimes absence of eyes. These defects are designated as blind, dull, irregular, miszler, pressler, overset / cabbage / blow holes etc.

18.9.3. Body and texture

The body and texture of high-quality Swiss cheese should be firm, closed, moderately flexible when bent and free from such defects as glass, pinholes, sponginess or bloats. Occasion picks (small, irregular or ragged openings) and checks (short cracks) may be tolerated, provided they are within 2 cm of the surface.

18.9.4. Finish and appearance of Swiss cheese

Swiss cheese should be symmetrical with a smooth, even, clean, dry and closedsurface. The ends of cheese pieces should be parallel neither bloated nor sunken, with surfaces free from cracks, nor all edges square. It is mostun desirable for cheese edges to exhibit long tabs or a cracked, open edge (frogmouth).

18.10. DEFECTS IN CHEESE

18.10.1. FLAVOUR DEFECTS

18.10.1.1. Slight (lacking in flavour development): Flavour detected only upon critical examination

Causes: in active starter, bacteriophages, inhibitors, too high cooking temp., insufficient starter, not increasing temp. to 70 F.

18.10.1.2. Flat: Insipid, practically devoid of any characteristic cheese flavour.

Causes: inactive starter, insufficient development of acid, high salt content which retards ripening, cheese being kept at 40 F or below during ripening, insufficiently cured & low moisture cheese.

18.10.1.3. Acid/sour: Sharp & puckery to taste, characteristic of lactic acid

Causes: high % of starter, large no. of lactic acid producing bacteria, adding starter too early before setting, too fast increase in cooking temp., too high % of acid at time of draining of whey.

18.10.1.4. Bitter: Distasteful, similar to the taste of quinine. Is mostly found in aged cheese

Causes: due to undesirable bacteria e.g. *S. liquefaciens* by the breakdown of proteins, high acid & moisture in cheese, growth of yeasts& too high acid in whey at draining & high amount of rennet addition

18.10.1.5. Fruity: Sweet fruit like flavour resembling apples increases during ageing.

Causes: Low grade milk, inferior starter, too much moisture, slow expulsion of whey, low salt %, unclean equipment and high ripening temp. (60-70 F), presence of *Ps. Fragi*

18.10.1.6. Utensil/ unclean: Flavour is suggestive of the improper of inadequate washing & sterilization of equipments

Causes: Low grade milk containing the undesirable bacteria, inferior starter, unclean and improperly washed equipments.

18.10.1.7. Yeasty: Flavour indicative of yeast fermentation

Causes: Unsanitary conditions of milk production, not cooling milk, yeasty starter, using yeast infested hoops, cloths etc., unsanitary cheese factory surroundings, no fly proofing done.

18.10.1.8. Rancid: Flavour suggestive of butyric acid due to lipase action on fat, sometimes associated with bitterness.

Causes: Late lactation milk in winters, presence of Ps. fragi and other psychrotrophs.

18.10.1.9. Whey taint: Slightly acid flavour &odour characteristic of the fermented whey.

Causes: Slow expulsion of whey, inactive starter, too much application of heat during cooking, uneven cutting & cooking, improper handling of curd.

18.10.1.10. Metallic: Flavour is suggestive of metal imparting a pucker sensation.

Feed: Feed flavours such as alfalfa, sweet clover, silage in milk is carried into the cheese.

18.10.1.11. Weedy: Flavour due to milk having common weedy flavour. Present when cattle has eaten weedy hay, weed infested pastures.

18.10.1.12. Branny : Flavour characteristic of the odour of the cattle shed.

18.10.1.13. Sulfide: An objectionable flavour of hydrogen sulfide similar to the flavour of water with high sulfur content.

18.10.1.14. Onion : Flavour is indicative of the aroma of the onions, garlic or leeks. Due to cattle eating these substances.

18.10.2. FINISH/ APPEARANCEDEFECTS

18.10.2.1. Cracked rind : Openings or breaks in the rind

Causes: dropping cheese, rough handling and its incorrect cheddaring, excessively drying cheese before profiting if no bandage or cloth circle is used on cheese& by bandage or press cloth wrinkled during profiting.

18.10.2.2. Checked rind (bruised surface): Numerous small cracks or breaks in the rind, sometimes following outlines of curd particles, sometimes referred to as “curd openings”.

Causes: Injuring the rind when removing the cheese from the hoop, rough handling.

18.10.2.3. Wrinkled/ burst/ torn/ irregular bandage: Severance of the bandage at the side seam or bandage irregularly placed or wrinkled with loose fitting.

Causes: careless work when dressing cheese.

18.10.2.4. Mould spots: Mould spots or areas that have formed under the wrapper or under the bandage/ paraffin or on the surface of the cheese.

Causes: insufficiently pressed cheese, cracked, checked or bruised rind, cheeseimproperly paraffined, high humidity & temp. & mould infested shelves in the curing room.

18.10.2.5. Soiled/ unclean surface: Milk stones, rust spots or other discoloration & dirt on the surface of the cheese.

Causes: using unclean hoops, utensils, equipments, soiled bandage, handling cheese with dirty hands, placing cheese on dirty trucks, shelves, dirt & insects incuring room.

18.10.2.6. Rind rot: Soft spots on rind that have become discolored & have decayed or decomposed.

Causes: dipping cold, damp cheese in paraffin for too brief a period, low temperature of paraffin.

18.10.2.7. High edges : Rim or ridge on the follower side of the cheese, which is raised in varying degrees or might be even bent over in extreme cases.

Causes: uneven position of pressing hoops, adding too much cheese to hoop, poor press cloths & fitting followers.

18.10.2.8. Defective coating : Brittle coatingor paraffin that breaks & peels off in form of scales/ flakes, flat or raised blisters or bubbles under surface of paraffin, cracked or breaks in coat.

Causes: if butterfat granules are formed in milk i.e. if milk is not properly cooled, rough handling of milk may cause churning. Blisters are formed by dipping paraffin before the cheese surface has dried or due to gas formation in cheese.

18.10.2.9. Lopsided/ uneven : One side of the cheese is higher than the other side.

Causes: improper dressing, pressing & handling of cheese cubes.

18.10.2.10. Soft spots : Soft to touch & spots are usually faded& moist.

18.10.2.11. Huffed: Swollen surface because of gas fermentation. The cheese becomes rounded/ oval in shape instead of flat shape.

18.10.2.12. Weak rind: Thin & possessing little or no resistance to the pressure.

18.10.2.13. Sour rind: A fermented rind condition usually confined to the faces of the cheese.

18.10.2.14. Wet rind : A rind in which moisture adheres to the surface & which may or may not soften the rind or cause colour defect i.e. discolouration.

18.10.2.15. Rough surface : Lacks smooth, clean, glossy & even surface.

18.11. COLOUR DEFECTS

18.11.1. Acid cut : Bleached or faded appearance which sometimes varies throughout the cheese appearing most often around the mechanical openings.

Causes: high acidity, moisture, curing room temperature.

18.11.2. Mottled : Irregular shaped spots in which portions are light coloured & others are highly coloured.

Causes: uneven colouring, cutting, drying of cheese, curdy starter, mixing old curd to salted cheese.

18.11.3. Colour specks : Specks of varying taints of white, yellow etc.

Causes: due to curd specks from starter, dry curd particles from sides of vat, dirt specks, frozen cheese colour, growth of colour producing yeasts and bacteria.

18.11.4. Seamy/ white lines : Thread like white lines that form in the pieces of curd.

Causes: bruising curd before milling, adding salt before temp. is reduce to 90 F, adding salt in one installment, pressing curd too quickly.

18.11.5. Unnatural: Deep orange/ pink/ reddish colour.

Causes: Annatto cheese colour is reddish if the cheese solution is acidic due to reaction with casein under acidic conditions.

18.11.6. Unattractive: Abnormal or unappetizing appearance, dull or faded or having bleached surface.

18.11.7. Salt spots: Large light coloured spots or areas of salt due to high concentration

Module 6. Fat rich Dairy Products

Lesson 19. Sensory Evaluation of Cream

19.1. INTRODUCTION

Cream is that portion of milk in which the fat is concentrated, usually by centrifugal separation It contains all the constituents of milk from which it has been separated out, but these constituents are present in different proportions. Cream differs primarily in the percentage fat, in the processing treatments, in bacteriological treatments and in the use made of them. Several kinds of cream are recognized commercially. These are

· Table cream: (16-22% fat), also called" coffee" cream. It may or may not be homogenized.

· Whipping cream: (30-40% fat), also referred to as 'double cream'

· Whipped cream: Whipping cream, which has been flavoured, whipped and delivered in whipped form

· Plastic cream: (70-80%) fat cream

· Low fat cream: (10-12% fat) also called half-and-half homogenized milk.

· Frozen cream: Sweet cream containing 50-75% fat, carefully processed and stored at 0-10° F. Used for making ice-cream mix.

· Devonshire cream: Obtained by hand skimming shallow pans of scaled whole milk. Also called clotted cream, scaled cream or cooked cream.

· Cultured sour cream: Heavy, smooth, viscous, sour cream prepared by ripening of cream by culture.

· Commercial sweet cream: High quality sweet cream for use in ice cream mix and other dairy products.

· Churning cream: (36-42% fat). Produced primarily for the purpose of being made into butter.

19.2. Scorecard forcream:

The American Dairy Science Association, through its committee on Judging Dairy Products has developed scorecard for fluid milk products, which can be used for milk, cream, chocolate milk, skim milk, low fat milk, and other fluid and flavored milks. The score card is as shown below:

Table-19.1: Score card for cream

<Table 19.1>

In addition to these items, viscosity, serum separation. cream plug and whipping quality might well be considered also.

19.2.1. Materials Required:

Cream/milk sample bottles, 100 ml beakers, plungers, sediment tester and standard sediment disks, thermometer, acidity testing set, etc.

19.2.2. Procedure:

1. Ascertain the condition and external appearance of the container and record observation as clean, attractive, dirty, loose lid, leaky, unsealed, dented, etc.

2. Open the cover/lid and smell the contents immediately and examine smell and appearance of cream simultaneously. Record observation as pleasant, sour as well as any other off flavour if any, clean, foamy, fat separation, etc. Examine the inner side of the lid for adhering factor foam.

3. Stir the cream with plunger and noted own the temperature.

4. Perform the sediment test and compare the discs with the standard sediment discs and also estimate its Titratable acidity.

5. Take about 50 ml of cream in a beaker from the sample and sip it. Roll it in the mouth for a few seconds and noted own the flavour, mouth feel, consistency, etc. It is advised not to swallow the cream. Note down the observations in accordance to as shown in the scorecard and give score after deducting marks depending upon the type and intensity of defect.

19.2.3. Desirable attributes:

In general, cartooned or bottled cream should have a clean, sweet, nutty flavour, be of uniform consistency, have a good physical appearance and good keeping quality.

The titratable acidity of all fresh cream should be consistent with the fat percentage of the cream There exists and inverse relationship between the percentage of fat and the percentage of titratable acidity.

Any sediment in cream is objectionable. In case of cream the bacterial limits are double those for pasteurized Grade A milk.

The coliform limit shall not exceed 10 per ml. The proposed bacterial limit of 30,000 for pasteurized market cream is in line with a high-quality product.

The order of examination, applying in large part to Table Cream in glass containers, should be as follows:

1 Serum separation

2 Sediment

3 Container and closure

4 Cream plugs

5 Bacterial count

6 Viscosity

7 Flavour

8 Acidity

9 Feathering

Table-19.2: Score card for Cream

*****☺*****

Module 6. Fat rich dairy products

Lesson 20. Butter: Specific requirements of high-grade butter, undesirable attributes of butter, butter score card, sensory evaluation of butter.

20.1. INTRODUCTION

Butter has a very mild and delicate flavoured which however is an important contributor to the product's acceptability. Texture of butter is very typical and its defects highly characteristic. Appearance is relatively less import but cannot be ignored.

20.2. DESIRABLE ATTRIBUTES OF BUTTER

High quality butter is expected to posses' mild, sweet, clean and pleasant flavor and a delicate aroma-which is due to the composite effect of flavour of butterfat and the flavour of the serum. To manufacture butter with most desired flavour the raw material used must be free from objectionable flavour defects. This is also true of cultured cream butter, which should have. a distinct, starter flavour aroma (diacetyls the principal component)

For evaluating butter flavour, the judge should recall the aroma notice date the time the tearful butter was obtained. The judge should then remove about 1 inch of the end section of the butter plug with a knife, spoon or spatula and place this in mouth. Butter should then be chewed and brought into a liquid state as soon a s possible. The sample should be manipulated with the tongue and jaws until butter sample reaches body temperature. The judge should then notice the first handoff taste or smell. The melted sample then may be drawn to the back of the mouth to notice the taste and smell. To prevent sensory adaptation, the sample of butter should not be kept in mouth for too long. All the sensory observations should be recorded on a score card by assigning each it means appropriate numeral value. Some of the common flavour defects associated with butter is discussed below.

20.3. Flavour defects:

20.3.1. Acid or sour: An acid off-flavour in butter is characterized by ash raps our taste on the rip of the tongue.

20.3.2. Aged: Butter lacks freshness, can easily be detected by smelling the sample or by noticing a moderately persistent aftertaste. The defect is caused by either holding butter too long at relatively low temperature or for short periods at relatively high temperatures.

20.3.3. Bitter: Bitterness resembles the taste sensate ion like 'quinine'. It persists') as a distinct, lingering an aftertaste, even after the sample has been expelled from the mouth. To detect it the sample should be melted in the mouth and rolled to the back center of the tongue where taste buds sensitive to bitterness a relocated.

20.3.4. Cheesy: Flavour resembling to that of cheddar cheese. From the instant of placing the sample in the mouth, through manipulation of the sample and subsequent expectoration to the last lingering aftertaste, this flavour defect is readily noticeable.

20.3.5. Briny/ High salt: A distinct 'Salty' taste that is beyond a range of ordinary acceptability.

20.3.6. Coarse: Butter that lacks the pleasant flavour sensation or the balanced taste and aroma that is anticipated in high quality product is referred to as 'coarse'. In fact, a course flavoured butter has reason ably good sensory properties but just seems of all short of the top or best quality product.

20.3.7. Cooked: Cooked flavour is generally associated with high quality (best grade) butter. This flavour is readily recognized when the core sample (within the trier) is passed under the nose or when a portion of the sample is first placed into the mouth.

20.3.8. Feed: Presence of different feed (hay, silage etc.) flavours. It can easily be detected in the aroma and verified on the palate when the butter is melted.

20.3.9. Fishy: Butter may have a flavour and aroma similar to codfish, cod-live roil or fish-meal. This is one of the most serious. Most pronounced and objectionable flavour defects of butter. It is an off flavour which is persistent, and the mouth distinctly fails to cleanup.

20.3.10. Fiat: Butter that simply lacks a characteristic full, pleasing 'buttery' flavour is criticized as being 'flat'. The absence of typical butter flavour is noted when the butter is first placed into the mouth.

20.3.11. Foreign: As described for milk and cream.

20.3.12. Garlic or onion: These off-flavours, cocas ion ally found in butter, are easily detected from characteristic smell.

20.3.13. Malty: As described for milk and cream.

20.3.14. Musty: The 'musty' Off-flavour in butter resembles he odour of a poorly ventilated musty smelling space or room. It is also attributed to the growth of as pacific spoilage micro-organism (*Ps eudomonas tac tr o l en s*).

20.3.15. Oxidized: Oxidized flavour is frequently noticed as surface taint in butter.

20.3.16. Rancid: Rancidity resembles the pungent, rasping taste and odour of darkened, decayed nut-means.

20.3.17. Tallowy: This off-flavour is caused by an extensive degree of oxidation of the unsaturated fat tyacids in milkfat. It resembles tallow.

20.3.18. Yeasty: A 'yeasty' off-flavour is detected in the early stages of devel open by the typical fruity, vinegary, and slightly fragrant aroma, which is apparent when the sample is first taken into the mouth.

20.4. Body and texture

The term Body & Texture is used to describe the physical property that is examined based on touch, appearance and mouthfeel. Though, the exact meaning of this term is not very clearly defined, in general body refers to the make-up of the mass while texture to the arrangement of the particles that make up the mass. Body & Texture is in fact so closely related that they are not considered separately in judging physical properties of a product.

20.4.1. Desirable characteristics

Body and texture of butter is affected markedly by temperature. It is necessary, there for to define the temperature at which these properties are evaluated. The tactile properties of butter should be evaluated at a product temperature between 7 and 13°C. Within this temperature range the body of the butter should be firm, waxy and consist of such closely knit granules that it appears as a uniform mass. Water and air, in proper amounts should be uniformly distributed and closely bound. The ideal butter should cut easily and evenly when sliced and be readily spreadable.

Some body and textural characteristics may be assessed by carefully observing the plug and back side of the butter trier. A good butte should not adhere to the back of the trier nor there any visible water droplets. The plug should be well rounded, have smooth, waxy breaks or openings. Some of the major body and textural attributes are

20.4.2. Body and texture defects in butter

1. Crumbly or brittle: Butter particles lack cohesiveness and do not hold together. Some of the butter usually adhere to the trier and reflect s rough appearance. Butter cannot be cut into neat portions for table use: it appears dry and readily falls apart.

2. Greasy: Greasy butter consistency may be noted by the evidence of extreme smoothness and immediate melting when a sample of such butter is placed into mouth. The defect may be suggested by the extreme ease with which a trier full of sample may be removed f r om the product.

3. Gummy: Butter does not melt readily when tasted but adheres to the root of the mouth. This defect is more prevalent in cotton seed fed area. The defect is due to higher percentage of high melting point glycerides. This defect markedly interferes with the spread ability of butter.

4. Leaky: Butter shows beads or droplets of moisture on the plug and/ or the back of the butter trier.

5. Mealy or Grainy: Butter shows ragged surface on the trier plug and does not spread or cut well. When taken into the mouth and compressed bet ween the tongue and palate, a distinct 'grainy' sense at ion is perceived.

1. **Sticky:** Butter sticks to the trier and appears to be quite dry. Usually it is difficult to secure a uniform, smooth surfaced plug from such butter, it appears ‘ragged or rough’. This is particularly true when the trier is cold. This butter is difficult to slice or spread.

7. Weak or Spongy: The defect is typically indicated by a quick meltdown and excessive softness of butter.

20.4.3. Colour and Appearance

The colour of butter may vary from light creamy white to dark creamy yellow or orange. While moderately high colour may be preferred in one region, a lighter colour may be considered more desirable in another. A uniform light straw colour may be the most acceptable to the consumer. The primary feature to observe in sensory evaluation of butter for colour is uniformity of colour.

20.4.3.1. Defects in colour &appearance

Faulty workmanship, particularly over and under working of butter during manufacture is responsible for most colour & appearance defects. The size, number and distribution of moisture and air droplets markedly influence the colour of butter.

1. Mottled: Butter with spots of lighter and deeper shapes of yellow.

2. Wavy or streaky: Butter with distinct waves of different shades of yellow, with colour in each wave uniform.

3. Speckled: Butter with coloured specks of foreign matter scattered through it.

4. Primrose or high colour surface: This is deepening of colour of the exposed surface of butter.

5. Mould discoloration: Moulds growing on the surface of butter may produce wide range of colours.

6. Salt: Salt renders the flavour of butter to be more at tractive. Preference for the amount of salt in butter may differ with individuals. Some consumers prefer a highly salted butter (> 2%), some desire a lightly salted <1.5%) while others prefer exclusively unsalted butter. Salt is not generally criticized in butter grading regardless of whether the butter is high or low in salt provided salt is completely dissolved (is not gritty) and it is not too's harp'.

In order to get a perfect score for salt, salt in the interior of the butter must be completely dissolved. Undissolved salt on the surface of an exposed sample of butter, does not necessarily indicate presence of undissolved salt in butter (gritty butter). The presence of 'grittiness' can most easily be detected by placing some butter between the molars and pressing together gently.

20.4.4. Package

Package serves to adequately protect the product. Butter package, whether for retail or wholesale, should be neat, clean and tidy in appearance. It should have good finish and should appear fresh and unsoiled.

20.4.5. REQUIREMENTS AND PROCEDURE FOR GRADING OF BUTTER

20.4.5.1. Tempering of butter

The temperature of butter at the time of grading is quite important for deter mining the true body & texture characteristic and to readily detect the dedicate aroma of bulls. Temperature of sample should be maintained between 7-13°C. Butter should be placed in the tempering room well in advance to allow tempering to about 10°C. (the required time will depend on relative size & temperature of but sample).

20.4.5.2. Use of butter trier

A butter trier should be used for drawing samples from butter block or package. Facilities for cleaning the trier (soft tissue or absorbent paper) and disposal of waste butter should also be provided. Use of hot water for cleaning the trier be avoided.

20.4.5.3. Use of butter score-card

Butter score card (Fig .1) and scoring guides are useful instruments for the butter grader. It assists him in the quality assurance endeavor of the organization.

Table-20.1: Maximum scores for butter attributes as per the ADSA score-card

Table- 20.2: A suggested scoring guide for the flavour of butter

Table-20.3: A suggested scoring guide for body and texture and colour and appearance in butter

20.4.6. Sequence of observation

a. Observe the cleanliness and neatness of the package.

b. Remove the cover / packaging material and observe the sample for its evenness and / or squareness of the wrapping material.

c. Insert the butter trier diagonally near the centre of the package and draw a sample plug of butter.

d. Immediately after withdrawing the plug pass the trier slowly under the nose, through the nose very slowly and notice the odour or aroma present.

e. Examine the colour for uniformity through.

f. Examine the body & texture by pressing the ball of the thumb against the side so the plug until it shows a break (observe the presence or absence of free moisture and their relative clarity and the nature of the break)

g. Break off approximately 0.5 to 1 inch piece from the end of the butter plug and place it into the mouth. Chew it until it melts and then roll the melted sample around the mouth till it reaches body temperature. Meanwhile examine the presence of 'grit' (undissolved salt) and the manner in which butter, melts. Also notice the various sensation softest and smell.

h. Expectorate the sample and carefully observe for the occurrence of possible after taste and persistence of any off-flavour.

I. After judging each sample rinse the mouth frequently with 1.0% warm saline water.

J. With the help of butter scoring guide record the assigned sensory score of the product.

20.4.7. Grading:

After computation of data recorded in Table 1 by the panelist the following gradation should be specified:

Table-20.4: Grading of butter

Module 6. Fat rich products

Lesson 21. Ghee and AMF: Grade of ghee and AMF, Special requirements of quality ghee and AMF, defects in ghee and AMF, ghee score card, sensory evaluation of ghee and AMF.

21.1. INTRODUCTION

The sensory attributes of ghee are affected by many factors, such as quality of base material, extent of lactic acid fermentation, time and temperature of heating, rate of cooling, package type, filling conditions, presence of oxygen and contaminants such as iron and copper, exposure to sunlight and temperature, and duration of storage. These factors should be controlled to produce ghee of premium quality.

The quality of ghee is judged by the desirable flavour, texture and colour, and freedom from suspended serum residues. The consumer wants an assurance of purity, freshness and wholesomeness. These attributes are assigned relative weight in a descriptive mode by the overall assessment of quality. A perfect score of 60 for flavour, 25 for texture, 10 for colour and 5 for freedom from suspended impurities is recommended for the judging of ghee. The intensity of each defect is given on a weighted rating scale.

21.2. Flavour

Aroma and taste constitute the flavour of ghee. A perfect ghee flavour is characterized by a multitude of sensory perceptions which are pleasant, enjoyable and lingering in the mouth. Consumers always resist any change in the flavour of ghee as this is one characteristic which predominantly determines acceptability. There are regional preferences for flavour in ghee. The preferred ghee flavours range from 'slightly curdy' to 'pronounced curdy', 'cooked' to 'caramelized' and, at times, slightly oxidized in some quarters of the population. The village-produced ghee is characterized by a curdy flavor which lingers in the mouth.

The quality and the amount of SNF present in the base material, as well as the intensity of heating separately and cumulatively, affect the flavour of ghee. Technologies have been developed using various alternate methods to produce ghee with both 'curdy' and 'cooked' type flavours.

The flavour of ghee is mainly contributed by the heat interaction products formed between the unfermented serum portion, comprising the native carbohydrate and protein system, and by metabolic products of the starter culture when ripened cream is used for ghee-making. The flavour components of ghee have been discussed in an earlier lecture. The 'curdy' flavour in ghee could be produced by mixing of ‘desi’ ghee with dairy ghee in varying proportions, by the addition of lactic cultures to butter at heating, by incubating the molten butter with a lactic culture, or by the addition of 1assi' powder at the time of heating.

'Cooked' flavour could be simulated by clarifying butter at temperatures of 115°c for 10min, or 120°c for 5 min, or 125°c without any holding time.

21.3. Texture

Granulation of ghee is an important criterion for its selection; a good grainy texture is very much appreciated by consumers, and such ghee develops a lower degree of rancidity than ghee kept in the liquid state. Milk fat has the unique property of forming grains because it is made up of a wide variety of complex triglyceride mixtures with varying melting points. The texture of ghee will depend on the source of the fat (animal species), method of preparation, temperature of clarification, rate of cooling, amount of FFAs, rate of seeding, and storage temperature. The presence of FFAs markedly increases the grain size, but the quantity of grains is increased only to a limited extent. Seeding with grains of ghee at the rate of 2% by weight of ghee improves grain formation. The

grain shape becomes needle-like, in contrast to the spherical shape obtained without seeding. The large number of fatty acid residues present in ghee result in a wide variety of crystallization patterns.

The maximum amount of solid fraction (about 74%) is obtained at 28°C in 20-24 hr from buffaloes' ghee, closely followed by cows' ghee (69.5°/0) and a distinct low in goats' I) ghee (30%). There can be significant differences in the melting curves of fat tram the milk of buffaloes, cows and goats. The changes in the conditions of cooling can have a pronounced effect on ghee texture. If ghee is cooled rapidly, a larger number of very fine crystals will be formed, all consisting of mixtures of high and low-melting fats, leading to smooth, grease-like character. Slow cooling of ghee from a temperature higher than the melting point will lead to formation of a few crystals with a high melting point. As cooling proceeds, more and more fat solidifies, forming a mass of large crystals suspended in liquid fat. Hard, greasy or waxy texture is not liked by consumers.

21.4. Colour

Buffaloes' ghee appears whitish in colour owing to the absence of carotene, which impartsa yellow colour to cows' ghee. In the village method of ghee-making, the development of greenish-yellow tinge in buffaloes' ghee is caused by the action of lactic acid bacteria. Ghee produced by the direct cream method has a darker colour compared to that prepared by the creamery butter process. Stratification results in a light colour. A more intense heating in the presence of a high SNF content will result in a darker colour, especially if the raw material has been fermented. Brown discolouration is a serious defect in ghee.

21.5. Common flavour defects of ghee

Although ghee has a better capacity to resist spoilage by elemental and microbial attack than any other milk product, it is common knowledge that, upon prolonged storage at ambient temperature, it undergoes oxidative changes. Reaction of oxygen with the 'unsaturated fat' is a major cause of spoilage. It gives rise to a typical, strong and disagreeable odour. Production of off-flavours accompanies the loss of nutritive value.

Auto-oxidation of ghee is aggravated by metallic contamination and sunlight. The' acceleration' effect of light is dependent on its wave-length. The visible light accelerates the decomposition of hydroperoxides. The effect of ultraviolet light on ghee is more pronounced than the impact of other rays. High energy radiations such as b and g rays exert a pronounced acceleration effect because they split hydroperoxides and also generate free radicals from molecules of unoxidized substrate.

This half-life of ghee is affected by the degree of unsaturation of fat, the temperature at which ghee is stored, the manner in which milk, for ghee-making is handled, uncontrolled fermentation during curdling, uneven heating during manufacture, and sanitary conditions of the vessels used for the production and storage of ghee.

A number of synthetic antioxidants, such as gallates (ethyl, propyl, octyl),butylated hydroxy toluene (BHT), tertiary butylhydroquinone (TBHQ), ascorbic acid, a -to copherol phospholipids, and some natural antioxidants, namely curry leaves, betel leaves, soya bean powder, safflower and 'amla' (*Phyllanthus ambica*), can be added in small amounts (permitted legally in different countries) with a view to achieve either prevention or retardation of the oxidation of fat during storage. Traditional practice of ghee-making in India involves the use of certain plant leaves for antioxidative properties. Curry and betel leaves are two commonly used herbs which are rich in phenolic compounds, predominantly hydroxy chavicol. These leaves also contain ascorbic acid, which may act synergistically. Curry leaves and betel leaves also contain many amino acids which serve as antioxidants. Studies have proved that the practice of boiling betel and curry leaves with desi butter at the time of clarification helps to improve the flavour, colour and shelf life of ghee.

Other commonly encountered flavour defects in ghee are burnt, smoky, rancid and tallowy. The origin of these flavour defects will be discussed.

21.6. Grading:

After computation of the data recorded in Table by the panelists, the following gradation should be specified

*****☺*****

Module 7. Frozen Dairy Products

Lesson 22. Desirable and undesirable characteristics of ice-cream, sensory evaluation of Ice cream.

22.1. INTRODUCTION

Many different kinds of frozen products are available for sale in the market. Some of the common ice cream varieties are: Plain, fruit, nut, bisque, parfait, mousse, pudding, lac to ices, sherbet, etc. The scorecard used and technique for scoring the different varieties is same, the scoring being different only in the standards of perception for the several flavored products.

22.2.ICE CREAM SCORECARD

Table-22.1: Score card for ice cream

22.3. Technique of ice cream scoring:

22.3.1. Tempering the samples:

Before scoring ice cream, it is necessary to hold the samples at a uniformly low temperature so the ice cream retains its physical properties. Yet, the temperature maintained must not be so low that the ice cream is intensely cold and unnecessarily hard. When ice cream is to cold, the recovery of the sense of taste from temporary anesthesia requires longer period than expected for satisfactory and efficient work. Generally, temperature from 5 to 10 F (-15 to-12 C) are satisfactory for tempering the ice cream for judging. This can best do by taking the ice cream out of hardening room and placing it in a dispensing cabinet several hours prior to judging. Exposing the stored ice cream to room temperature for tempering purposes is very unsatisfactory as tile ice cream. melts along the edge of the container while the center remains too hard for dipping.

22.3.2. Sequence of Observations

22.3.2.1. Examine the container: Observe the type (i.e. paper/metal) and condition of the container, the presence or absence of a liner and cover and any package defect that may be present.

Note the colour of the ice cream: Observe the colour of the ice cream, its intensity and uniformity and whether the hue is natural and typical of the flavour of the ice cream being judged.

22.3.2.2. Sample the ice cream: During the actual dipping of the ice cream, note carefully the way the product cuts and the feel of the dipper as its cutting edge passes through the frozen mass. The "feel" of dipping, i.e. the resistance offered, the evenness of cutting, the presence of spiny ice particles, and whether the ice-cream is heavy or soggy, or light and fluffy should be noted. The way the sample responds to dipping often gives a fairly accurate impression of its body and texture characteristics.

22.3.2.3. Begin Judging: Soon after securing the sample, examine it for body and texture characteristics, for flavour and for melting quality.

Take dipper full of ice cream in a flat bottom dish and observe its melting quality. High quality ice cream should show little resistance towards melting when exposed to room temperature. Observe whether the ice cream has

retained its form and approximate size, even though some [Tee liquid has oozed out; whether the melted liquid is creamy, curdled, foamy or watery.

By placing a small portion of ice cream in mouth and pressing it against the root of the mouth (to melt the sample quickly), the smoothness, the coarseness, the coldness and the presence of sandiness and the relative size of the ice crystals may be determined.

22.3.2.4. Sense of flavour: While manipulating the sample about the mouth to ascertain some of its body and texture characteristics, the flavour will soon manifest itself in a taste sensation. The first flavour suggested will be one of the fundamental tastes if present, and in the order of salt, sweet, sour and bitter. As the sample is warmed in the mouth, any volatile, flavour-contributing substance will soon give rise to reaction of smell. Since sweetness is always noted prior to the volatile, odour contributing substances, its characteristics should be studied at once. Observe whether the ice cream is pleasantly sweet, intensely sweet, lacking in sweetness or unnatural. By the time the quality of sweetness is judged, other flavours should be also noted, particularly whether the flavour is coarse or delicate, mild or pronounced, and whether the flavour is creamy, pleasantly rich or possesses a pronounced, unnatural taste and whether the mouth “cleans Lip " after the sample has been expectorated.

The melting quality of ice cream shall be correlated with the properties of body and texture.

Tabulate the records of observations in the ice cream score card chart & classify the result.

22.3.2.5. Requirements of high-quality vanilla ice-cream

The colour should be attractive, uniform, pleasing and typical of the flavour represented. (Usually vanilla ice cream is not coloured although some manufacturers do add colour), the ice cream should have a colour in harmony with the flavour used. Colour defects may include gray (dull), not uniform, too high (vivid), too pale (chalky, leaching) and unnatural.

The package or container should be clean, neat, attractive, full and protective. The containers should be free of dents, rust, paint, ink smears, battered edges or rough surfaces. The common defects encountered in package are soiled, rusty or damaged containers; ice cream shrunken from container or ill-shaped package; and lack of parchment on containers.

22.3.2.6. Melting quality

High-quality ice cream should show little resistance toward melting when a dish is exposed to room temperature. During melting the mix should drain away as rapidly as it melts and form a smooth, uniform, homogeneous liquid in the dish. The defects in melting quality observed in ice cream are does not melt/delayed melting/ high melting resistance; flaky', scummy, lacks uniformity, foamy, frothy, large air bubbles; whey -off, curdled and watery/ low melting resistance.

22.3.2.7. Body and Texture

The desired body in the ice cream is that which is firm, has substance, responds readily to dipping and melts down at ordinary temperatures to a creamy consistency. The desired texture is that which is fine, smooth, velvety and carries the appearance of creaminess throughout. The body defects commonly encountered in ice cream are crumbly/ brittle/ short/ gummy/ pasty/ sticky/elastic, shrunken, soggy/ heavy/ doughy, and weak/ watery. The texture defects are: Buttery/ greasy/ coarse/ grainy/ icy/ flaky/ snowy, fluffy/ foamy, lumpy and sandy.

22.3.2.8. Flavour

Vanilla ice cream should be pleasantly sweet, having a creamy, leaving only a very pleasant after taste. Neither the vanilla (or any other flavour depending upon variety of ice cream), the sugar, nor the dairy products should be so pronounced that when first tasted one is more striking than the others. All the ingredients should blend to yield

a pleasant, balanced flavour. Off flavours in ice cream may come through several sources- e.g. (1) ingredients used- such as dairy products (cooked, feed, old ingredient, rancid, salty, etc.), flavoring(coarse, lacks fine flavour, too high! excessive, deficient, unnatural) and other ingredients (egg stabilizer, other solids than milk solids): (2) due to bacterial growth in the mix (cheesy, musty, sour); (3) due to chemical changes in the mix (flat, metallic, stale, oxidized, storage); (4) due to other causes(neutralizer. foreign).

22.4. Sensory quality office-cream:

Uniform good quality ice cream must be one of the biggest assets in the continued expansion of the ice cream industry. So far, no such grades and standards have been developed in the ice-cream industry. Different score cards and other systems of measuring quality have been suggested from time to time, but none of these have become standardized. In view of the fact that ice cream is now included in the Educational Students Dairy Products Judging Contest at the Eastern States Exposition and that serious consideration is being given towards including ice-cream in the National Contest.

According to this score card, the factors that make up quality in ice cream are: Flavor, body and texture; bacteria color and package. The score card measures these quality factors by assigning to each certain value which is as follows:

Percent

Flavor 50

Body and texture . . . .: 25

Bacteria. 20

Package and color 5

In general, a sample receiving a score of 90 per cent may be considered excellent, while a score of 80 to 90 would be representative of a good quality of ice cream. Scorecard or yard stick for measuring quality similar to the above, has now been used for two years at the Eastern States Dairy Products Judging Contests and also at the Educational scoring.

22.4.1. FLAVOR

The quality of the flavor of ice cream may be classified from the standpoint of palatability under four general groups:

1. Highly pleasing and desirable: Flavors rating 45 to 50 points.

2.Desirable flavors: Flavors rating 40 to 44.9 points.

3.Objectionable flavors: Flavors rating 35 to 39.9 points.

4. Foreign(off) flavors: Flavors rating 25 to 34.9 points.

1. Highly pleasing and desirable flavors: Rating 45 to 50 points

Ice cream that is especially fresh, clean, sweet and well blended in flavor, having the proper degree of sweetness and flavoring and having a certain creaminess or richness in flavor characteristic of the pleasing flavor and aroma of fresh sweet cream, shall receive a rating of 45 to 50 points.

Descriptive terms: Fresh, clean, creamy, well blended.

2.Desirable flavors: Rating 40 to 44.9 points

Ice cream that is fresh, clean, creamy and sweet in flavor, but high or low in sweetness or flavoring material shall be given a rating of 40 to 44.9.

Descriptive terms: Too sweet, lacking sweetness, too high flavoring, lacking flavoring.

3.Objectionable flavors: Rating 35 to 39.9 points

This class includes ice cream that is free from foreign, (off) flavors but shows objectionable flavors, such as old cream, old butter, bitter, cooked, condensed or powdered milk, gelatin or unnatural flavoring or unnatural flavoring such as pronounced glucose. Such ice cream shall receive a rating for flavor of between35 and 39.9 points.

Descriptive terms: Old cream, old butter, old egg butter, cooked condensed milk, powdered milk, gelatin, unnatural flavoring, unrecognizable.

4. Foreign(off) flavors: Maximum rating 25 to 34.9 points

These include flavors, ordinarily termed foreign flavors (off) flavors which are distinctly disagreeable to the taste. Ice cream showing salty, rancid, garlic, gasoline, disinfectant, unclean utensils or any other foreign (off)flavor distinctly disagreeable to the taste, shall be given a score of 25 to 34.9points.

Descriptive terms; Salty, rancid, garlic, gasoline, disinfectant, unclean utensils, unrecognizable.

Ice cream with pronounced sour or other flavors bad enough to make it unsalable, shall be score 0 on flavors.

Note: Ice-cream is never scored perfect in flavor, as no one knows what perfection is and2 to 4 points leeway must be allowed. A score of within 2 to 4 points of perfect may therefore be considered excellent.

22.5. BODY AND TEXTURE

Class I: Rating 23 to 25: Ice cream receiving the rating of 23 to 25 must be firm, smooth and velvety in body and texture. Descriptive terms: Firm, smooth, velvety.

Class II: Rating 20 to 22.9: Ice cream that is slightly fluffy, crumbly, icy, coarse, buttery, weak I. e. (nonresistance), or soggy shall receive a rating of 20 to 22.9. Descriptive terms: Fluffy, crumbly, icy, coarse, buttery, weak, soggy.

Class III: Rating 15 to 19.9: Ice cream that is sandy, pronounced soggy, buttery, icy, coarse, crumbly, weak, gelatin lumps, shall receive a rating of 15 to 19.9. Descriptive terms: Sandy, soggy, crumbly, buttery, icy, coarse, weak, gelatin lumps.

22.6. PACKAGE AND COLOR

A. Colour:

The suggested standard color for vanilla ice cream is the color of. Guernsey or Jersey cream during the month of June or July with allowance for deeper shades of color when eggs are used in the mix. However, the different markets vary greatly regarding the degree of color desired in ice cream. In the case of vanilla ice cream these

requirements vary from almost white to a deep egg yellow: In order to meet these requirements for color in ice cream the following shall be used as a basis of rating on color:

1. Ice cream in order to receive the full rating of 5 points must be free from specks, unnatural or uneven colours.

2. Ice cream showing dirt specks, unnatural colours or uneven colours shall be cut not exceeding 2 points according to the degree of the defect. Descriptive terms: Dirt specks, unnatural, uneven.

B. Package:

Ice cream receiving the full rating of 5 points must be neatly and solidly packed in clean, non-rusty cans and tubs, the cans being provided with parchment paper circles over the top. Ice cream packed in unclean, rusty cans, or not provided with parchment circles shall be cut not exceeding 2 points according to the degree of the defect. Descriptive terms: Unclean, rusty cans, no parchment. With this exposition before you the following are some of the many questions that might be raised and discussed:

22.7. Defects in Ice-cream

22.7.1. Flavour Defects:

1.Cooked: Caused by using milk products heated to too high a temperature or by using excessively high temperatures in mix pasteurization. It can dissipate with time, the same as cooked defect in fluid milk. Caramel-like, scalded milk, oatmeal

2. Egg: Caused by using too much egg in an ice cream not specified as custard ice cream. French vanilla ice cream - resembles cooked

3. Unnatural Flavoring: Caused by using flavours which are not typical of the designated flavour i.e. Wintergreen flavour on vanilla ice cream. esp. Vanillin

4. High Acid: Use of dairy products with high acidity or hold inmix too long and at too high a temperature before freezing.

5. Lacks Fine Flavour: May be caused by using harsh vanilla. Good but falls short of ideal. Last resort in trying to describe flavour defect.

6. Lacks Freshness: Stale flavour caused by permitting ice cream to remain in hardening room or cabinet too long before sale. Minor, more major-becomes old ingredient or storage

7. Metallic: Sometimes develops from oxidized flavored usually caused by copper or iron contamination. Poor grade of vanilla has been known to cause this flavour.

8. Neutralizer: Results from the use of too much neutralizer in the mix. Soda flavours usually more objectionable than lime flavours.

9. Old Ingredient: Caused using inferior dairy products in the preparation of the mix. Powders made from poor milk or butter made from poor cream will contribute to old ingredient flavour.

10. Oxidized: Caused by oxidation of the fat or lipid material such as phospholipids, similar to fluid milk oxidation. Induced by the presence of copper or iron in the mix. Mono-and-di-glyceride, Polysorbate 80. Various stages - card board, metallic.

11.Rancid: Caused by rancidity of certain fats. May be due to use of rancid dairy products or to insufficient heat before homogenization of mix. Egg yolk powder may also be the cause. Lipolysis, especially of butyric acid.

12. Salty: Ice cream too high in milk solids-not-fat. Too much salt may have been added to the mix. Whey powder, maybe salted butter, whey flavour graham crackerlike

13. Storage: Usually develops from "Lacks Freshness" and is most pronounced on ice cream which has been held in a stale storage atmosphere. Maybe described as an "old ice box" flavor.

14. Unnatural Sweetener May be confused with a cooked flavour which sometimes produces a caramel taste. May be caused by too much corn syrup especially if corn syrup has strong flavor. Some vanillas also produce a caramel flavour.

22.7.2. Body and Texture Defects

22.7.2.1. Course Texture: Due to the presence of ice crystals of such a size that they are noticeable when the ice cream is eaten and may be caused by:

· Insufficient total solids, serum solids, sugar, stabilizer or poor stabilizer.

· High acid mix

· Insufficient homogenizing pressure, Homogenizer not functioning properly.

· Insufficient aging of the mix.

· Slow freezing because of mechanical condition of freezer.

· Incorporation of air as large cells because of physical characteristics of mix or type of freezer used.

· Fluctuating hardening room temperatures and hardening soft ice cream.

· Pumping ice cream too far from continuous freezer.

22.7.2.2. Crumbly Body: A flaky or snowy characteristic caused by:

· High overrun.

· Low stabilizer and Low total solids.

· Coarse air cells.

22.7.2.3. Fluffy Texture: A spongy characteristic caused by:

· Incorporation of large amount of air as large air cells.

· Low total solids and Low stabilizer content.

· Freezing ice cream too soft in freezer.

22.7.2.4. Gummy Body: This defect is the opposite of Crumbly in that it imparts a pasty or putty-like body. It is caused by:

· Too low an overrun, too much stabilizer and poor-quality stabilizer.

22.7.2.5. Icy Texture: This defect is caused by many of the same factors which cause coarse texture, except that defect is much more pronounced.

22.7.2.6. Sandy Texture: One of the most objectionable texture defects but easiest to detect. It is caused by Lactose crystals which do not dissolve readily and produce a rough or gritty sensation in the mouth. This can be distinguished from "iciness" because the lactose crystals do not melt your mouth. This defect can be prevented by:

· hardening the ice cream quickly

· maintaining low hardening room temps.

· preventing temp. fluctuations...from manufacturer to consumer

· lactose crystal formation is further discussed in the Dairy Chemistry and Physics section.

22.7.2.7. Soggy Body: Caused by:

· High total solids, High sugar content, High stabilizer content

· Low overrun.

22.7.2.8. Weak Body: Ice cream lacks "chewiness" and melts quickly into a watery liquid. Gives impression of

Lacking richness. May be caused by:

· Low total solids.

· High overrun.

· Insufficient stabilizer.

22.7.3. Melting Quality Characteristics

22.7.3.1. Curdy Melt-Down: Due to coagulation of the milk proteins so is affected by factors which influence. The protein stability such as:

· High acidity and Salt balance.

· High homogenizing pressures.

· Over-freezing in the freezer.

22.7.3.2. Does not Melt: May be caused by:

· Over stabilization.

· Wrong stabilizer.

· High fat.

Excessive fat clumping in the mix due to homogenization at too low a temperature or single-stage homogenizer.

· Freezing to too low a temperature at freezer.

· Use of calcium neutralizers.

22.7.3.3. Wheeling off: The salt balance, protein composition, carrageenan all are factors.

22.8. Colour Defects

22.8.1. Colour Uneven: Applies usually to ice cream in which colour has been used but may be noticed in vanilla ice cream under some circumstances.

22.8.2. Colour Unnatural:

Wrong shade of colour used for flavoured ice-cream.

Too much yellow coloring used in vanilla ice-cream.

Greyish color due to neutralization.

Table-22.1: Score card for Ice cream

Key for recording:

*****☺*****

Lesson 23. Desirable and undesirable characteristics of Kulfi and milk sherbets. Sensory Evaluation of Kulfi and Milk sherbets

23.1. INTRODUCTION

Sherbets, or milk lollies and water ices, or ice lollies, as defined above are the frozen products containing none or very little milk solids in comparison with ice-cream; these are usually fruit-flavoured and acidulated. Thus, these products not only contain less food solids and more water, but also have higher concentrations of the sweetener. Their fruit and acid content impart a characteristic flavour and tartness, and the 'ice-rich' structure gives the product a typical, chewy texture.

23.2. Product quality and probable defects

Sherbets and ices have nearly the same firmness as that of ice cream, at the dispensing-cabinet temperature of about -15°C. However, the texture may range from smooth, chewy to coarse, and body from heavy to light depending upon the formulation especially with regard to the level and type of sweeteners. The type and level of stabilizer also greatly influence the body and texture characteristics of the product as discussed in the fore-going paragraphs. Flavour wise, these products are characterized by a tart taste in combination with the fruit-typical flavour. The flavour perception may, however, be influenced by flavour release which is often governed by the type and level of stabilizer used.

Flavour defects in sherbets and ices are similar to those found in ice cream but the milk product-related defects are usually less frequent owing to lower concentrations of milk fat and MSNF. Unnatural, harsh or excessive, artificial, and excess or less sweetness may be encountered more frequently. Coarse, crumbly, hard, snowy etc. are some of the product-describing terms as far as body and texture defects are concerned. Surface cru station and bleeding are also the defects developing due to faulty, formulation with regard to the types and levels of the sweetener and stabilizer. Abnormal melt-down may be observed as too fast or too slow and curdy. Appearance defects include non-uniform and unnatural or high colour.

23.3. Ice milk or low-fat ice cream

Ice milk as defined by the FDA is the food prepared from the same ingredients and in the same manner as prescribed for 'ice cream', however its milk fat content is more than 2% but not more than 7%, MSNF content not less than 4%, total milk solids content not less than 11 %, and it may contain added caseinates; it shall contain not less than 156g food solids per liter. No such product-definition exists under PF A Rules at present. However, the market trends indicate a definite scope for such low-fat frozen desserts under our situation as well.

Low fat ice-cream (i.e. ice milk) may be frozen hard or sold in the form of a soft-serve product, as practiced in the USA. In spite of its reduced fat content it is expected to taste like normal ice-cream. Therefore, the formulation in terms of total solids content, and emulsification and stabilization must be such that the resulting product has body and texture characteristics similar to those of ice cream. To be able to be served directly on drawing from the freezer, the low-fat product should have dry appearance, and stiff body which necessitates that the right kind of emulsifier system be used in the mix-formulation. The soft-serve product usually has a lower sugar content (e.g. 13%, with 30-34 % TS) as compared to the hard-frozen product (15% with 35-38% T.S.). Work carried out at this Institute showed that a good quality low-fat ice cream containing 6.0% fat and 12.5 %MSNF, could be obtained by using 0.35% stabilizer (a 70. :30 blend of *isabgol* husk and guar gum) and 0.08%Tween 80 as emulsifier and ageing the mix for 16 h. A soft- serve ice milk composition has been reported to include (0.1% lecithin, 0.15% pectin and 0.1%xanthan gum and/or locust bean gum.

23.4. KULFI

23.4.1. Introduction

Kulfi is a very popular traditional frozen milk product of Indian origin which provides pleasures of eating. Any satisfactory method for its industrial production has so far not been developed. Itinerant traders have evolved simple technology using an open pan for concentration of milk, followed by addition of locally manageable ingredients, and use of ice salt mixture for freezing. The unhygienic conditions prevailing at the Kulfi making centers and apathy of the traders for adopting sanitary practices may cause health hazards to consumers. Scarcity of published data on the chemical, microbiological and sensory attributes and paucity of information on mechanized production methods discouraged the organized dairy sector to initiate the industrial production of Kulfi.

The studies on quality of market Kulfi samples sold in Karnal and Delhi markets showed wide variations in the chemical, microbiological and sensory properties. The average total solids values of 39.04 and 44.54 per cent in samples of Kulfi collected from Karnal and Delhi markets were accompanied with large variations in fat (6.56 to 11.65 per cent in Karnal and 10.07 to 13.87 %in Delhi samples) and sucrose (13.92 to 17.92 in Karnal and 14.37 to 20.46 in Delhi). Distinct variations between samples were also observed in protein, lactose, ash, and physic-chemical properties like titratable acidity, relative viscosity, surface tension and melt down quality. Low fat product was criticized by the panel of judges.

Most of the market samples of Kulfi showed the presence of the different types of micro-organisms. The average microbial counts in Kulfi samples per g for Karnal and Delhi markets respectively were: TVC 127.15 x 105 and 15.52 x 105; coliforms 61.73 x102 and 6.20 x 102; staphylococci 26.32 x 10^5 and 8.46 x 10^5;and yeast and Mould 6.14 x 10^2 and 2.11 x 10^2.

22.4.2. Sensory properties

The sensory qualities of most preferred samples of Kulfi by the consumers were described as slightly cooked to caramelized flavour, creamy taste, fine grainy texture and slight brown colour. Addition of cardamom, pistachio, almonds, cashewnuts, etc. Adds variety to Kulfi. Presence of large sized ice crystals, coagulated milk particles and fast melt down diminished the product acceptability.

22.5. Package

Kulfi is either sold in an individual cone of triangular, conical or cylindrical forms made from galvanized iron sheets Orin capped plastic Moulds. ‘Matka’ kulfi is also popular. The net weight of market samples of Kulfi in cones varied from 95.0 to 107 g. The retail price per cone of Kulfi during the year 1997-98 ranged from Rs. 10 to 14. Despite its widely fluctuating properties, Kulfi is generally preferred over ice cream, because of low cost and detectable sensory attributes.

*****☺*****

Lesson 24. Concentrated Milks: Desirable attributes and defects, judging and grading of evaporated and condensed milks.

24.1. INTRODUCTION

Critical quality assessment of all classes of concentrated milk challenges both the dairy products judge and the manufacturer of these products. A thorough understanding of the sensory attributes of concentrated milk and their routine examination is imperative, not only to assure improvement of the product, but also for ensuring that the product reaches the consumer in good condition.

24.2. EVAPORATED MILK

When judging or grading evaporated milk, the judge must keep in mind the desirable qualities and standards for the product. It must be noted that, in addition to meeting the legal chemical requirements for the product high quality evaporated milk must be white to creamy in colour, have a relatively viscous body, be uniformly smooth in texture and possess a mild, pleasant flavour.

A complete examination of evaporated milk includes test and observations encolour, container, if fat separation, fill of container, film formation (protein break), flavour, gelation, sedimentation, serum 'separation, viscosity and whipping ability.

Some of the subjective tests, based on organoleptic examination, make use of the hedonic scale or variations of it. For example, the flavour of evaporated milk may be given a hedonic rating on a 9 -point scale. A narrow band hedonic scale says, a 5-point one, may be used in rating organoleptic quality factors other than flavour.

24.2.1. Procedure for examination

A routine in examining cans of evaporated milk facilitates judging of the samples. The following steps have been found to be of material aid in going over a lot of samples.

24.2.2. Precaution: Avoid undue agitation when transporting the cans to the laboratory.

1. Examine the cans for appearance, notice the upper end of the can for polish; observe the neatness of the label.

2. Open the can in such a way the both the can and contents may be examined.

3. Notice the colour of the milk which should be uniformly white to cream colour. Intensity of darkening may be noted for its degree e.g. none, slight, distinct and pronounced.

4. Study the body and texture. Smooth, relatively viscous evaporated milk pours like a thin cream without marked splashing. Allow the can to drain well. Look for any deposit which may be present in the bottom of the can.

5. Should the milk lack uniformity try to determine whether the chief factor is fat, protein, salts or foreign material? In case the fat is responsible, the defect will appear at the top of the can as a cream layer or as buttery particles. Defect due to protein will appear as various size curds distributed throughout or as different intensities of gelation.

6. Observe the condition of the container looking for spangling, blackening of the seam and rusting of the container. Splanging appears as clean, bright, dark, overlapping blotches on the surfaces though the tin were attacked by acid. •

7. Determine the colour reaction in coffee. It should be a rich, golden brown colour. Off flavour may be associated with rust formation in the container. '

8. Note the miscibility with coffee. Feathering in hot coffee appears as finely divided, serrated curds shortly after the evaporated milk has been added slowly to the hot coffee.

24.2.3. Defects in evaporated milk

1.Flavour

The flavour defects which may occur in evaporated milk are usually unlike those commonly occurring in fresh milk. Probably the most common flavour defect in evaporated milk is that which seems to be associated with progressive age darkening or browning of the product. Terms such as slightly acid, 'stale coffee, old, sour 'and strong suggest the nature of the defect. The caramel flavour connotes a pleasant, appetizing taste sensation which is definitely lacking in the defect associated with age-darkening of evaporated milk. This flavour defect is easily detected.

The off-flavour is accompanied by only a slight odour suggesting staleness. The underlying taste reaction of the age darkened evaporated milk is acid.

2. Body and texture

Fresh evaporated milk is remarkably free of body and texture defects. However, when evaporated milk is held for a long period of time or under adverse conditions, the following body and texture defects may be encountered:

3. Buttery/fat separation: This defect appears as a layer (up to 1 cm or more thick) of heavy cream at the top of the can. Among the causes of this defect are inadequate homogenization, high storage temperature, long storage period and improper handling while in storage.

4. Curdy: Curdy evaporated milk may be noted by the presence of many coagulated particles interspersed throughout the milk or by a continuous mass of coagulum. It is chiefly associated with the protein rather than the fat. It is a serious economic defect. This condition is due mainly to the abnormally low heat coagulation point of the end product and could not withstand the sterilization process.

5. Feathering: The feathering of evaporated milk in hot coffee cannot be foretold by macroscopic examination but by actually testing the milk in hot coffee.' It has been postulated that the formation of curd when evaporated milk is added to coffee is due entirely to an excess of viscosity.

6. Gassy: Gassy evaporated milk is rather uncommon. The defect is manifest by bulged cans and sometimes by a hissing sound of escaping air when the can is punctured.

7. Grainy: A grainy evaporated milk is the one lacking smoothness and uniformity throughout. Such milk seems coarse. It is often associated with an excessively heavy, viscous body. The judge must bear mind that grainy evaporated milk does not actually contain "grams" of sediment settled in the container. Neither does such milk contain curds or lumps of butter.

8. Low viscosity: A low viscosity evaporated milk may be noted by its milk like consistency. This defect is discriminated against as it denotes inadequate condensation.

9. Sediment: The sediment resulting from settling of leukocytes, disintegrated cells, denatured 'protein and foreign material of more or less of a colloidal nature is usually darker in colour than the evaporated milk since this sediment is readily miscible it may be seen only when a can, undisturbed for some time, is emptied slowly.

The other type of sediment noted in evaporated milk is the result of the crystallization of some of the calcium and magnesium salts as $Ca_3Po_4$and Mg_3 (PO_4). This gritty sediment formation accompanies ageing of the evaporated milk. They are found in the bottom of the container where they may be noted especially when the contents are emptied.

10. Colour

In judging evaporated milk two possible colour defects may be encountered, viz. too light in colour and too dark in colour. Too light colour is not it serious defect although it is not desired. The brown discolouration in evaporated milk associated with high sterilization temperature, high storage temperature and age is a serious defect in evaporated milk.

24.3. Sweetened condensed milk

Since sweetened condensed milk contains a sufficiently high percentage of sugar for its preservation, the flavour is pronouncedly sweet. Beyond this intense sweetness, the flavour should be clean and pleasant with a slight trace of mild caramel as an aftertaste.

24.3.1. Procedure for examination

1. A definite routine enables the judge to make the best use of the available time with the assurance that the examinations complete when finished.

2. Appearance of the container should be as bright as new tin as the can has not been subjected to the high heat treatment of sterilization.

3. The surface of the product should have the same intensity of colour as the under layer and should be uniform inconsistency with no indication of lumps, free fat or screen formation.

4. Colour of the product should be uniform throughout. Observe if the milk has a greenish white creamy or a brownish colour.

5. Viscosity desired is one which is obviously not "thin" but resembling to a marked degree that of medium to heavy molasses. In grading sweetened condensed milk, the judge must bear in mind that a desirable sweetened condensed milk pours like molasses and, when poured, seeks its own level leaving no trace of the folds on the surface.

6. Flavour should be observed both for the textural and taste sensations. Register the relative smoothness of the products a whole and the fineness of the grain by pressing the sample against the palate with the tongue.

24.3.2. Defects of sweetened condensed milk

24.3.2.1. Flavour

a) **Metallic: The** metallic flavour in sweetened condensed milk is chemical rather than bacterial in nature and is usually traceable to copper contamination.

b) **Rancid:** It occurs rather infrequently and resembles butyric acid. Rancid flavour increases in intensity with age.

c) **Strong: It** is a flavour defect, which is suggestive of caramelized sugar and is usually accompanied by browned tint to the natural colour.

24.3.2.2. Body and texture

Condensed milk, having a high percentage of sugar has a relatively heavy body somewhat like normal molasses. Also, it usually has a smooth, uniform texture. However, the product may have certain body and texture defects such as buttons or lumpiness, fat separation, gassiness, sandiness, sediment, thickening etc.

a) **Buttons/lumpy: It** is a body defect which is characterized by the presence of round and rum lumps, with stale odour, at the surface of the product. Buttons result from enzymatic reactions following Mould growth.

b) **Sandy, rough, grainy, granular:** These terms are used to describe sweetened condensed milk which contains oversized lactose crystals. The solid particles are of such size that the product lacks smoothness and grittiness is noticeable as the sample is being tasted.

c) **Settled: It** is used to describe the condensed milk in which a definite settling of sugar crystals has occurred.

d) **Thickened: This** defect is manifest by a gel formation which gives the product the appearance of a solid rather than a liquid. The defect varies markedly in its intensity from a slight jelly to a firm custard consistency.

Table-24.1: Score card for Sweetened Condensed Milk

Name Date----------

Code No. Time ----------

A) Score the sample for different characteristics. Indicate the degree of defects, if any, encircling the applicable one and deduct accordingly from the characteristic score.

<Table>

NOTE: If the sample scores less than the minimum for any characteristic, it is to be rejected.

B) **Degree of defects**

<table>

Grading: After computation of data, recorded in the above table by the panelists, the following grade should be awarded

*****☺*****

Module 8. Concentrated and Dried Products

Lesson 25. Dried Dairy Products: Desirable and undesirable characteristics of dried dairy products. Judging and grading of dried dairy products.

25.1. INTRODUCTION

Evaluation of milk powder, whole or skimmed, based on its sensory characteristics plays an important role in its marketing. Those who buy milk powder consider its sensory properties, such as flavour and appearance for its acceptability. The sensory examination of milk powder assumes great significance in our country in particular, not only because skim milk powder (SMP) is manufactured in large quantities at feeder balancing plants in the flush season for its subsequent reconstitution during the lean period so as to maintain the milk supply to the needy areas but also as it has become an important export commodity.

25.2. Dry whole milk

In judging whole milk powder (WMP) for flavorsome first classifies the product for flavour as good, fair or poor.

25.2.1. Flavour

Treavor of dry whole milk should be clean, rich, sweet and pleasant. Frequently, dry milk may be unduly criticized as having a ‘heated’ or a ‘cooked' taste. This may be expected or even desired. Often, dry milk gradually loses its sweet, fine, appetizing flavour upon aging, thus becoming more or less off flavoured. The more frequently occurring flavour defects of dry whole milk are

25.2.2. Stale, storage, old: This appears to be a characteristic age defect associated with protein. When the defect is intense it may be accompanied by a darkening of the product.

25.2.3. Rancid: Rancid dry whole milk has bitter, soapy, unclean taste which is persistent after the sample has been expectorated. The reason may be insufficient forewarning temperature to inactive the lipase enzyme.

25.2.4. Oxidized/tallowy: It is the most troublesome flavour defect of dry whole milk. Many factors affect the development of this defect such as temperature, light, moisture, acidity, metallic salts, condensation and type of packaging.

25.2.5. Scorched: This flavour is produced in products which have been subjected to excessive heat during the drying stage or have been permitted to remain in the drying chamber for too long period of time. It is usually accompanied by many scorched specks in the product and sometimes by a dark discolouration typical of overheating.

25.3. PHYSICAL CHARACTERISTICS OFWMP

25.3.1. Body and texture

Two defects pertaining to the body and texture of dry whole milk are lumpy and caked.

1. Lumpy: A lumpy powder lacks homogeneity. Hard lumps ranging in size from again of wheat upwards may be interspersed throughout. This defect is found frequently in the spray process product. Lumps result from insufficient drying, dripping from spray nozzles or exposure to moisture laden air.

2. Caked: Usually this defect is not encountered in dry whole milk, when it does occur the product loses its powdery consistency and becomes a rock like solid. When the mass is broken up, it remains in chunks, thus failing to return to the original powder state. This defect is serious since such milk solids have lost their sales value for human consumption.

25.3.2. Colour of WMP

Normal dry whole milk is light yellow in colour but varies reasonably with the coloring the fat from a creamy white to a deep yellow. The defects of colour in dry whole mill as follows;

1. Browned or darkened: This defect is associated with age. When the defect is present, the normal creamy colour has been replaced by a distinct brown. The defect is usually associated with an old, stale flavour.

2. Scorched: Discolouration due to browning of the milk solids is usually associated to the roller process. The powder may vary from light to dark brown.

3. Lack of uniformity: This defect may be due to either partial discolouration (browning) after packaging or to partial scorching during the manufacturing process.

25.4. Skim milk powder (SMP)

25.4.1. Flavour

The flavour of high quality nonfat dry milk is similar, when reconstituted, to the fresh skim milk. Due to its low fat content, it does not possess the rich flavour of high milk powder. The flavour is clean, sweet and pleasant and may have a slightly cook~ heated note. The chief flavour defects of nonfat dry milk are

25.4.2. Stale, storage, old: This flavour defect is the chief one of nonfat dry milk. In this product the off-flavour is even more "quick" and distinct than in dry whole milk. Usually the flavour defect is accompanied by a darkening of the powder. The old, stale flavour develops usually more intensely in spray process than in roller process powder.

25.4.3. Scorched: As in dry whole milk, this flavour is produced in products which have been subjected to abnormally high heat during processing.

25.4.4. Oxidized/ tallowy: Nonfat dry milk contains a small percentage of fat which oxidizes under some conditions yielding the oxidized or tallowy flavour. A tallowy product has a pronounced odour whereas stale powder does not have a very intense odour.

25.5. PHYSICAL CHARACTERISTICS OFSMP

Nonfat dry milk prepared by spray process is very fine in particle size and uniform throughout. Instead of being flour like in texture, instant SMP is more or Less granular. The product pours readily somewhat like that of corn meal. The highly hygroscopic, light, air-borne dust of normal spray process SMP is lacking.

25.5.1. Colour of SMP

Nonfat dry milk should be uniform in colour through showing the absence of foreign specks and burnt solids. The product should have a creamy white or light yellow colour which varies slightly in intensity with the season of the year. Upon ageing under certain conditions SMP tends to darken. When this defect occurs the light yellow colour has given way to a definite brown. Spray process powder appear to be more susceptible to age darkening and to a greater intensity than roller-process powder.

25.5.2. Malted milk

25.5.2.1. Flavour

Malted milk, being composed in large part of maltose and dextrose, has a definitely sweet taste. It should have a distinct flavour of malt. The product should be judged for its lack of malt flavour and for oxidized flavour defect.

25.5.2.2. Body and texture

Malted milk has a coarse and grainy texture unlike the fine texture of spray dried milk. While judging, product must be examined for possible stickiness and formation of cakes because of its affinity for water.

25.5.2.3. Industry standards for grades of dry milk

The American dry milk industry has adopted standards for dry whole milk and nonfat dry milk. These are based on product quantity and provide two grades for each process as follows:

<Table>

The tolerances permitted for flavour and appearance in Premium and Extra Grades are as follows: "Premium and Extra grade dry whole milk shall be free from lumps except those that break up readily under slight pressure. There constituted product shall have a sweet and. desirable flavour but may possess the following flavour to a slight degree: Chalky, cooked and feed".

The tolerance for the standard grade is "Standard grade dry whole milk shall be free from lumps except those that break up readily under slight pressure. The reconstituted product shall possess a fairly desirable flavour but may possess a bitter, oxidized, stale, storage, utensil and scorched flavour to a slight degree and a chalky and feed flavour to a definite degree."

25.5.3. Method of reconstituting dry milk for flavour examination

Generally, in examining dry milk for odour and taste, the product is reconstituted one the basis of the original concentration. The American Dry Milk Institute (ADMI) recommends examination of dry milk odour immediately after the containers are opened and again for flavour approximately one hour after the sample has been reconstituted. The judge must be mindful of, the fact that freshly prepared fluid milk made from water and food quality dry whole milk often possesses a slightly chalky, watery or slightly cooked taste. Hence permitting a short storage period for blending of flavours after reconstituting the product should aid the judge in determining more accurately the true flavour.

Table-25.1: Score card for Milk Powder

Name Date

Code No. Time

A) Score the sample for different characteristics. Indicate the degree of defects, if any, encircling the applicable one and deduct accordingly from the attribute score.

<Table>

NOTE: If the sample scores less than the minimum for any characteristic, it is to be rejected.

B) **Degree of defect**s

*****☺*****

Lesson 26. Khoa: Desirable and undesirable characteristics of different types of Khoa. Sensory evaluation of Khoa.

26.1. Preamble

Khoa or mava, the traditional Indian indigenous dairy product, is mostly used as a base for a variety of Indian sweets. Khoa is a partially desiccated whole milkprepared in open pans by direct application of heat.

Accordingto PFA Khoa should be made from cow, buffalo, sheep or goat or combination of these milks by rapid drying and should not contains less than 20 % fat in the finished product. However, the Indian Standard specifications in addition specify the quality of milk to be used for its manufacture as well as the sensory quality of the product. It also requires that Khoa must have not less than 37 % fat (on dry basis).

In general, three types of Khoa are made in this country viz., Pindi, Dhap and Danedar depending on end use and basic composition

Table-26.1: Types of Khoa

In order that the sensory panelists are made aware of the desirable/undesirable characteristics of khoa, they need to be exposed to various types of khoa. The panelists should first be trained to identify good quality product made from cow and buffalo milk.

26.2. Sensory requirement of khoa:

26.2.1. Flavour: A typical mildly cooked flavors similar to that perceived from boiled milk is most acceptable. The taste should be pleasantly sweet.

26.2.2. Body & texture: Soft & uniform body and granular texture is most desirable. Pindi khoa should have smooth, compact, homogenous texture with very fine grains. Whap khoa shall have a granular texture with a slightly soft body. Danedar khoa shall have big grains with brown colour.

26.2.3. Colour & appearance: Good quality khoa should be a compact mass of very small uniformly sized granules which should not show any signs of fat or water leakage and should not develop grittiness after 24 h storage. Cow milk khoa is pale yellow with a tinge of brown having a moist surface.

Table-26.1: Desirable sensory qualities of cow and buffalo milk khoa

26.3. Undesirable sensory attributes in Khoa

Thereafter, the panelists should be trained in recognizing the defects commonly associated with khoa and its degree by providing them with good quality products containing various levels of individual defects. Some of these common defects observed in khoa can be simulated as stated below:

26.3.1. Flavour defects

Table-26.2: Flavour defects

26.3.2. Body and Texture Defects:

<table>

26.3.3. Colour and Appearance Defects

<table>

The defects caused by packaging have not been discussed since in general khoa whether in large or small scale is delivered in consumers own container or at most in polyethylene bags.

In order to unify the scoring system for khoa, a 100-point scale scorecard is being suggested. Since flavour is the most important attribute it is usually assigned the maximum score of 45, followed by 35 for body and texture, 15 for colour & appearance and 5 for package. It is also necessary to assign a minimum score for each sensory attribute below which the product is automatically rejected. For this purpose, 60 % of the individual attribute score has been generally proposed and accepted. Hence, any product sample scoring less than 27 for flavour, 21 for body and texture, 9 for colour &appearance or 3 for package should be rejected.

After having trained the panelists for recognizing the various defects and their degrees, the use of scorecard. They will then be ready to evaluate samples of khoa. Khoa should be evaluated by deducting points for each defect/ intensity of defect from the total score of that attribute and final score on the card. The composite scores can then be analyzed statistically to arrive at the best product/ process etc. under test.

*****☺*****

Module 9. Heat Desiccated Indian Milk Products

Lesson 27. Khoa based sweets: Desirable and undesirable characteristics of different types of khoa based, i.e. Peda, gulabjamun etc. Sensory evaluation of khoa based sweetes.

27.1. INTRODUCTION

Gulabjamun is a very popular khoa based Sweet all over India. The product is prepared by kneading good quality khoa with about 10 % Maida and/or suji and about 1 %baking powder (optional), followed by preparing balls (10-15 g weight), which are than fried in hydrogenated oil or ghee at about 125 - 130 C for 15 - 20min. The fried balls are then soaked in about 60 % sugar syrup for 6 - 12 hours before consumption.

27.2. PROCEDURE

1. Examine the package of gulabjamun (if the product is supplied for judging in the original pack) for its package quality', soiling at the outer surface, etc.

2. Open the container and record general appearance to include colour, shape, evenness of the surface, size of the product, presence of yeast and/or Mould growth, etc.

3. Cut the product with the help of a spatula/ spoon and observe the resistance to cut and then internal texture of the product.

4. Take small quantity of product in the mouth and examine for taste, aroma, body and texture. Expectorate the production the mouth and note the after taste.

The desired attributes of gulabjamun are light brown colour, round/spherical shape with moderate size, smooth and glossy surface, soft and spongy body, soft and thin crust, free from lumps and hard central core, uniform granular texture, mild cooked flavour, moderately sweet, free from doughy feel and fully saturated with syrup.

Table-27.1: Quality attributes of gulabjamun

Table-27.2: Scorecard for Gulabjamun

Table-27.3: Scorecard for judging of Gulabjamun

Key for recording

<table>

27.3. Sensory requirement of burfi

Moderately sweet taste

Mildly caramelized and pleasant flavour

Soft- very loosely compacted to closely knit body

Slightly greasy surface

Smooth to granular and crisp to chewy texture with fine grain

Colour– white or slight yellowish

27.4. Sensory requirement of Peda

Colour: White to brown

Flavour: Slight heated to burnt

Texture: Soft, greasy to dry and grainy

Shape: Round

Compare to burfi, Peda is slightly more granular in texture and having dry body and lower moisture content.

Module 10. Heat and Acid Coagulated Milk Products

Lesson 28. Paneer: Desirable characteristics of paneer and defects, Judging and grading of paneer.

28.1. INTRODUCTION

Paneers an important, acid coagulated indigenous milk product, which is extensively used as an ingredient for preparing cooked vegetable dishes in Northern India. Paneer is preferentially made from buffalo milk (6 % fat) by heating it to 82 C for 5 min., cooling to 70 C and coagulating with acid solution/ acid or sour whey. The whey is then drained and pressed for 15 - 20 min. The pressed paneer is then removed, cut into pieces and immersed in chilled water for 2 - 3 hours.

Although traditionally produced by small entrepreneurs, the organized dairies in northern India have recently taken to commercial production of paneer. With increase in large-scale production of paneer, it is necessary to have uniform chemical and sensory quality of the product. While the chemical aspects are well established, the systematic guidelines on sensory evaluation on paneer are discussed in this exercise.

28.2. Paneer Score Card

A scorecard is a tabulated list of the factors contributing towards the quality of the product with a numerical value assigned to each factor. It serves as a guide in determining the quality of paneer in terms of numerical values. The paneer scorecard is given in Table 1 (a).

28.2.1. Condition of judging room:

The judging room should be well ventilated and free from any foreign odours. There should be plenty of light so that the uniformity and shade of colour can be readily determined.

28.2.2. Tempering the Paneer:

The delicate aroma / flavour and body and texture characteristics of most of the dairy products can be best be determined when the products are neither too cold nor to warm and paneer is no exception. The paneer should, therefore, be tempered to 15.5 C to 20 C before judging.

28.2.3. Sequence of Observations:

When starting to judge the sample, the judge should note in sequence; first, the type and condition of the package i.e. for any package defects that may be present, having noted the condition of the container, the judge should observe next the colour and appearance of the paneer. Note whether the hue is natural or dull and whether any visible dirt / foreign matter is present. Observe the surface more closely for any surface skin formation or for the dry or mouldy surface. After having made these observations the judge may then sample the paneer. A representative sample can be obtained with the help of sharp bladed knife. While cutting the paneer, the judge should note the "feel" of cutting; that is, the resistance offered and evenness of cutting. This furnishes the indications of possible body & texture defects.

After having secured a sample, examination of flavour and further body and texture characteristics may begin at once. Immediately after cutting the piece of paneer, pass the freshly cut surface slowly under the nose to ascertain the aroma. This is important as some aromas become less intensive and disappear when exposed to air. Observe then the nature and extent of opening in the paneer. Take small piece of paneer between the thumb and fingers and work it up, observing its resistance to pressure and the type of break. This gives idea about hardness/ softness, crumbliness, etc. Place small portion of paneer into the mouth and chew it up to semi solid state. Note the resistance to crush during mastication of paneer. Roll it about in the mouth and observe deflator and mouthfeel (mealiness, coarseness etc.). Expectorate the sample and note the aftertaste.

28.2.4. Desirable sensory characteristics of Paneer

The package of paneer should be neat and attractive. The paneer should have uniform, pleasing white colour with greenish tinge for buffalo milk paneer and light yellow for cow milk paneer.

The flavour of paneer is a characteristic blend of the flavour of heated milk curd and acid. The flavour of the high-grade paneer, should be pleasing mild acid, slight sweet and nutty. A desirable body of the paneer is the one that is neither too firm nor too soft. It should be sufficiently firm to hold its shape during cutting/slicing yet tender enough not to resist crushing during mastication. The texture of the high-grade paneer should be compact (close knit), smooth and velvety.

28.3. Undesirable sensory characteristics of Paneer:

28.3.1. Flavour Defects and their characteristics:

1. **Acid/Sour: This** flavour defect results from use of either excessive acidic milk for paneer making or use of excessive amount of coagulating acid/sour whey. This flavouris usually very pronounced and may be detected by passing the freshly cut piece of paneer under the nose. When a portion is tasted, a "quick" flavour sensation is noted, which soon disappears, leaving the mouth free of any off-flavour sensations.

2. **Putrid/Cheesy: If** paneer is held too long at warm temperature protein-splitting organisms may breakdown the protein resulting in a cheesy, putrid flavour. The presence of this flavour is easily detected from the very first, due both to its intensity and to its cheesy characteristics. From the placing of the sample and its later expectoration to the last taste, this flavour is noticeable. The flavour is persistent and the mouth fails to clean up.

3. **Rancid: Rancid** flavour is the result of fat hydrolysis due to lipase action in paneer during storage at room temperature or above. The rancid flavour resembles somewhat to the strong, bitter, disagreeable flavour of darkened, decayed nutmeats. The presence of this flavour is easily detected both by the sense of smell and by the sense of taste. The rancid sample gives characteristics aftertaste and mouth fails to clean up.

4. **Stale:** When paneer is held too long at low temperature (5 C) it often becomes stale. The stale flavour is easily detected both by the taste and smell. The flavorist very prominent and has characteristics after taste.

5. **Bitter:** The bitter flavour is normally associated with the rancidity It may also be due to the impurities in the coagulating acid used. The bitter flavour can easily be detected by sense of taste. It persists even after sample has been expelled from the mouth.

6. **Musty: Musty** flavour may be caused by storing paneer in damp, musty smelling room; or due to mold growth the flavour is prominent and is noticeable even when the sample has been expectorated.

7. **Yeasty: The** yeast contamination during cold water immersion of paneer or during packaging and excessive long storage at low temperature gives yeasty flavour to paneer. This flavour is easily detected by its typical fruity, yeasty and slightly fragrant aroma, which is apparent when the sample is first taken into the mouth.

8. **Flat: Then** paneer that lacks characteristics, pleasing mild-acid, slightly sweet nutty flavour is criticized as flat.

9. **Foreign: The** exposure of paneer to the fumes from the combustion or burning of kerosene, diesel or petrol or contamination of paneer with fly repellants, disinfectants. may cause foreign flavour in the paneer.

10. **Smoky: Smoky** off-flavour in paneer is often encountered when smoky fire is used for boiling and simmering of milk.

11. **Feed/ Weed:** This off-flavour can be carried over to paneer if it is present in milk, feeding of aromatic feeds or obnoxious weeds shortly before milking often taints the milk. These flavours can easily be detected by smelling.

12. **Unclean/Utensil:** The unclean or utensil flavour is suggestive ofuncleanli'1ess or lack of freshness. It is caused by storing milk / paneer in improperly washed cans or utensils. The off flavour is apparent as soon as the sample reaches the palate. It also lingers a short time after the paneer is expectorated.

28.3.2. Body and texture defects:

1. **Hard: The** too firm or hard body is caused due to the use of lo\y fat milk or due to low moisture content of paneer as a result of faulty production techniques. The hard body is the one, which resists crushing during mastication.

2. **Soft: The** soft bodied paneer is due to high moisture content resulting from delayed straining or use of low coagulation temperature.

3. **Pasty: The** excessive retention of moisture in the product often gives pasty texture. The low coagulation temperature and lower coagulation pH often give fine curd particles which clog the pores of drain cloth and result in a product that has pasty texture. The presence colostrum's in milk also tend to give pasty texture.

4. **Crumbly: A** crumbly-bodied paneer is the one, which tends to fall apart when sliced oppressed between the fingers. The defect is closely associated with the mealiness. The frozen storage of paneer often results in crumbly-bodied paneer.

5. **Rubbery/Chewy:** The rubbery bodied paneer is the one which resists pressure if squeezed between the thumb and forefingers and shows a slight tendency to spring back when the pressure is released. It also shows considerable resistance to crushing during mastication.

6. **Mealy/Coarse:** Mealy or coarse texture may be caused due to use of low fat, high acid milk, or use of too high coagulation temperature or too low coagulation pH. Frozen storage of paneer may also give a coarse texture. Mealy textured paneer gives com meal like sensation during chewing of paneer.

7. **Open: Open** or loose texture is manifest by mechanical holes which are characterized by their irregular, annular shape and size. These holes result from improper matting of curd due to insufficient pressing.

28.3.3. Defector Colour and Appearance:

1. **Dull: This** defect is easily recognized by its dead, unattractive appearance. Such a defect suggests uncleanliness in manufacture.

2. **Dry Surface:** Use of milk containing excessive amount of fat gives paneer with dry surface such a product has unattractive appearance.

3. **Surface skin: A** long time exposure of paneer to atmosphere air results into drying of surface and formation of surface skin.

4. **Visible dirt / foreign matter:** The defect occurs due to several reasons such as incorrect or no straining of milk, dirty utensils, dirty/windy surroundings during manufacture or handling of paneer and transportation an unpacked / poorly packed product.

5. **Mouldy surface:** Long storage of paneer in humid atmosphere coupled with higher moisture content flavours mold growth on the surface. The product with such a defect is inedible and should be rejected.

28.3.4. Defect of Packaging:

The paneer produced in unorganized sector is normally sold, at present, in an unpacked condition. The paneer produced by organized sector is packed in modem packages such as polyethylene pouches, laminated pouches, etc. Some defects in packaging encountered are soiled / greasy packages or damaged packages. These defects are obvious.

28.3.5. Guide for scoring grading of paneer

Even if the above-mentioned defects are accurately identified or recognized, it is often difficult to ascribe proper score to them It is especially true for the beginners. A compilation of evaluation of various defects of paneer made based on intensity of defect and their relative importance in relation to paneer quality is given in Table 2. While these scores are not infallible or ultimate and are subject to change, it is believed that they serve as a good guide for the evaluation of various defects of paneer.

After having done the scoring of paneer, it can be graded into different classes either according to the total score (Table - 3) or according to the score of different i.e. flavour body and texture etc. (Table 4). The Table 4 gives the reclassification of various defects that can be tolerated for different classes of paneer.

Table-28.1: Guide for grading of Paneer based on total score

Table-28.2: Guide for grading of Paneer based on attribute

*****☺*****

Module 10. Heat and Acid Coagulated Milk Products

Lesson 29. Chhana and Chhana based Sweets: Desirable and undesirable characteristics of Chhana and Chhana based sweets Sensory evaluation of chhana and chhana based sweets.

9.1. INTRODUCTION

Chhana is an important Indian milk product obtained by precipitation of whole milk with sour whey, lactic acid or citric acid. According to PF A rules (1983) chhana shall not contain more than 70 % moisture and milk fat content shall not be less than 50 % of the dry matter. Chhana is used as a base material for preparation of Rasogolla and Sandesh which are very popular sweetmeats. The brief method of the preparation of chhana is; heating milk to boiling, cooling to 80 C, slowly adding of coagulant till required coagulation of milk takes place and finally draining of whey through a muslin cloth.

29.2. DESIRABLE CHARACTERISTICS OFCHHANA

29.2.1. Colour and Appearance

Good quality chhana should have uniform light yellow colour. In certain parts of the country calcium lactate is used as a coagulant, which will produce chhana of bright white colour. Chhana made from buffalo milk will also have whitish colour. The surface of chhana should be even and slightly moist. It should be neither too moist (nor wet) not dry. There shall not be any visible soil or burnt particles.

29.2.2. Flavour

Chhana should not have any abnormal flavour. Good quality chhana has no specific aroma. However, mildly acidic smell and pleasant sweetish taste are desirable flavour attributes of chhana

29.2.3. Texture

Thesis the most important sensory attribute of chhana. The quality of sweets will largely depend on the tex1ure of chhana. For making good quality Rasogolla, chhana should have moderately soft and uniform texture. It shall show slight springiness when pressed with thumb. A small piece of chhana crushed to pasty consistency and rolled between palms of both hands, it should yield round ball of even surface and no cracks. Good quality chhana should not release or separate fat on kneading or working.

Buffalo milk is not preferred for making chhana because it yields a product of hardbody and chewy texture. Chhana of such consistency will be difficult to convert into Rasogolla balls. Therefore, cow milk is always preferred for chhana making.

29.2.4. Sequence of observations

The first step in sensory of chhana is the examination of packaging material, which should be neat and clean and able to protect the product from environmental contamination. Then remove the packaging material and observe the colour and appearance of the product. Even the smallest defect should be noticed carefully. Simultaneously,

inhale the odour of the product. For further assessment of flavour, take sufficient quantity of chhana into the mouth.

While rolling into mouth and chewing in between teeth, note the tactual and taste sensations. Finally expectorate the sample and note if any after taste persists Texture of chhana should be evaluated by: (a) pressing and rolling, small piece of chhana in between the forefingers and thumb to note the hardness stickiness. and (b) spreading small mass of chhana on the palm of the hand with the thumb to observe uniformity, size and toughness of grains.

Table-29.1: Sensory score card for chhana

While scoring chhana for sensory quality, the judges should carefully observe the presence of different defects and their intensity.

29.2.5. Defect in chhana

29.2.5.1. Colour and Appearance

1. **Lack of Uniformity:** Normally chhana is made in small batches and several batches are mixed together for supply or sale. If there is variation in the type and quality of milk and heating conditions, the colour will vary from batch to batch.

2. **Moist\ dry surface:** The moist or wet surface is due to the presence of too much free moisture in the chhana. Surface of chhana becomes dryas a result of evaporation of moisture. this defect caused due to improper packaging or use of poor-quality packaging material.

3. **Mouldy surface**: Spots of different size and normally green or black are visible on the surface of the product. This is on account of mould growth due to post processing contamination. Unhygienic handling of chhana, packaging in poor quality material and storage under high humid conditions are other reasons for the contamination and growth.

4. **Visible foreign matter\ soiled:** In many cases foreign matter, normally soil, is present in chhana. This can be detected by visually as well as by tasting the product in the mouth. Improper straining of milk and manufacture and packaging of chhana under open! unsanitary conditions are main causes for this defect Sometimes black or brown particles are also visible in chhana, which is due to localized burning of milk solids.

29.2.5.2. Flavour defects:

1. **Smoky:** Though not very serious, this flavour defects is most common in chhana. This defect arises due to the manufacturing of chhana on a smoky wooden fire.

2. **Burnt/cooked:** This defect in chhana commonly develops as a result of uncontrolled heating of milk particularly at last stages.

3. **Sour/acidic:** This defect can be easily detected by the sense of smell and taste. It may be due to over acidification of milk, use of high strength coagulant solution. It may also be due to use of sour milk for making chhana or storage of chhana at ambient temperature for longer period.

4. **Metallic:** This defect can be detected easily by tasting the product and observing the mouth feel. The taste of products having metallic flavour resembles that perceived by tasting rusted iron. Metallic flavour defect is quite common in many Indian milk products.

5. **Oxidized:** Many times, there is confusion between metallic and oxidized flavour. But pure oxidized flavour develops due to the oxidation of some fatty constituents of cyanate oxidized is characterized by a quick taste reaction when the sample is taken in the mouth and gives sensation of paperboard, sallowness, oily etc. The oxidized flavour is also persistent after the sample is expectorated.

6. **Rancid:** The flavour resembles butyric acid. Rancidity results from the hydrolysis of the fat due to lipase enzyme secreted by bacteria or those in the milk itself Since the milk intended for chhana making is heated up to boiling, the enzyme is completely inactivated. So, this flavour defect in chhana occurs rather infrequently. However, if the milk is already rancid, it will produce a rancid chhana.

7. **Stale:** This is normally observed in the products stored for a longer under refrigerated conditions. The product with this defect does not have the typical pleasant flavour present in the fresh sample. Chhana may also produce this defect.

29.2.5.3. Texture defect:

1. **Hard/ Dry body:** Chhana with firm body feels solid and offers resistance to pressure. Chhana with hard body gives serious problem ink needing and making Rasogolla balls the dry chhana has not cohesiveness and when meshed to form balls, it breaks into small pieces. This defect is caused by low retention of moisture in chhana either due to use of low-fat milk or faulty manufacturing procedure. Coagulation of milk at high temperatures, application of excessive pressure to drain off whey or for prolonged period may cause this defect. Due to evaporation of moisture from the surface, the casehardening in chhana also takes place.

2. **Loose/sticky/ wet:** Product with these defects, sometimes, is also called as gooey or adhesive. Such a product adheres inside or packaging material. These defects in chhana are invariably due to high moisture content. Such defects occur because of faulty manufacturing technique i.e., coagulation of milk at low temperature, improper draining or for short periods and high acidity in the product. Product with these defects has poor shelf life and difficulty is encountered in rolling uniform Rasogolla balls.

3. **Grainy/ mealy:** This defect can be detected by rolling small piece of chhana in the mouth or spreading slowly on the palm of hand with thumb. Such product lacks cohesiveness and on kneading scatters into small individual grains. Normally grainy texture is accompanied with dry body. This defect is attributed to the use of high acid milk, or higher concentration of coagulant at higher temperature.

4. **Chewy/ rubbery:** Showiness can be detected by length of time required to masticate the chhana sample at a constant rate of force application, to reduce it to a consistency suitable for swallowing. Such product lacks softness and great problem is encountered in kneading or working for making sweets. Use of low-fat milk and delayed draining of whey from chhana are the possible reasons for such defects.

29.2.6. Training of Panelists

For efficient evaluation of chhana, it is desirable that the judges have sufficient training in identification of defects and their intensities. Detecting colour and appearance, and texture defects is not so difficult as those of flavour. For this purpose, samples representing following flavour defects should be prepared and served to the judges along with control samples.

Table-29.2: Flavour defects in channa

29.3.RASAGOLLA

Though Rasogolla is a very popular product in the eastern part of the country, it is gaining popularity throughout the country. The product is prepared by kneading chhana to a soft and smooth dough with or without optional additives (such as suji, Maida, cardamom pieces, etc.), followed by preparation of chhana doughballs, cooking

them in boiling sugar and then soaking and preserving in sugar syrup (40 % concentration) in sealed tins or in glass jars until used.

29.3.1. Requirement for high grade Rasogolla:

A highly acceptable product possesses white colour, round shape, pleasant flavour, soft body and maximum sponginess. The common defects of Rasogolla include brown colour, flattened shape, less sweet and caramelized flavour, hard and loose body, decomposed and grainy texture.

Table-29.2: Score card of Rasogolla

Key for recording

<table>

29.4. Sandesh

Sandesh is a popular chino based sweet of eastern India and Bangladesh. It is broadly classified in 3 main varieties:

1. Low moisture / Hard grade – Kara Pak
2. Medium moisture / Soft grade – Naram Pak
3. High moisture – Kaccha gola

Soft grade is the most selling variety in India. There are wide differences in the chemical composition, microbiological qualities and sensory characteristics of market samples. The variation in the quality of milk and methods of preparation are responsive for changes in the quality of finished product.

29.4.1. Sensory characteristics of Sandesh

Table-29.2: Soft Grade

Table-29.3: Hard Grade

29.5. Kaccha Gola

<table>

*****☺*****

Module 11. Consumer Acceptance Studies

Lesson 30. Objectives, Methods, types of questionnaires, development of questionnaires,

30.1. INTRODUCTION

Consumers acceptance and preference study is an important tool to decide the acceptability of the any dairy/food products by large group of the people. To conduct a successful consumer survey, one must know the important factors which may influence once survey results and conclusions. These factors are categorized in two groups:

1. Consumer related factors and
2. Product related factors

Consumer related factors areas under.

1. Availability

2. Utility

3. Convenience

4. Price

5. Uniformity and dependability

6. Stability, storage requirements

7. Safety and nutritional value

8. Sensory properties

a. Appearance

b. Aroma and taste

c. Texture, consistency

d. Temperature

c. Pain

Products Related factors are as follows.

1. Regional preferences

2. Nationality, race

3. Age and Sex

4. Religion

5. Education, Socio-economics

6. Psychological motivation

a. Symbolism of food

b. Advertising

7. Physiological motivation

a. Thrust

b. Hunger

c. Deficiencies

d. Pathological conditions

It becomes very difficult to ascertain the role of sensory attributes of the product in getting any food selected by consumers. These all complete factors interact and influence the consumer's decisions. The objective of the study should not only be sensory evaluation but there should be a total approach to know why consumer has accepted or rejected the product. A good product packed nicely may not be accepted by consumer because of its high price tag.

It is obvious that the sample with lowest cost with relatively good sensory attributes will be selected and excellent samples with high prices will not found in their selection lists. The excellent samples with a very high price are likely to be rejected for a given target population. Price is an important limitation of the freedom, which the consumer selects.

30.2. Regional preference

Some regional food preferences exist for specific dairy products such as ghee (variation in flavour preference curdy in the west and cooked in the south) and shrikhand (liked in western region). The sample survey for sensory attributes may differ from one region to another region due to their age-old perceptions and preference. However due to organized country wide production of dairy products like ghee and free movement of products, the regional preferences seem to be decreasing to some extent.

30.3. Page and Sex

The age of the consumer has been reported to influence preferences for some food products. According to one of the studies, filled yoghurt (with milk fat as control) prepared with maize, sunflower groundnut or olive oil was given to three age groups (<20, 20 -30and > 30 years). All the 3 groups related control yoghurt highest and sunflower yoghurt lowest, but only the 20 – 30-year age group detected any appreciable difference between the other 3 types of yoghurt,

Difference in personality, sensory acuity and likes and dislikes are usually more pronounced between people of the same sex than between the two sexes as groups. There are, however, group differences between the sexes which can be effectively used in planning and conducting market survey campaigns.

30.4. Other factors

Interest, motivation, discrimination, intelligence, and many other attributes of consumers undoubtedly influence responses to food. Individual variation in sensory acuity influences responses at consumer level as well as in the laboratory. The interrelationship of physiological nutritional and psychological factors must be taken into account for conducting extensive surveys of factory and taste abilities of the potential consumers.

30.5. METHODOLOGY

The target of conducting particular consumer market survey governs the selection of methodology, population, age group and sex, and type of questionnaire to be used. This objective has its typical attributes and problems which are to be taken into consideration before conducting the actual survey. The objective of a survey may be:

i. Introduction of new products.

ii. Quality assessment and control of existing products.

iii. Determination of market potential.

iv. Establishment of specific factors of importance to the consumers.

v. Effect of group feeding.

vi. Impact of advertising campaigns and educational programmers.

vii. Testing of methods and statistical producers.

30.6. Different approaches

There are following different approaches to collect the response of consumer.

i. Historical, based on past records of sales and turnover,

ii. Observational based on data collected by trained person (s) on the behavior of consumers in the market and

iii. Through well worked and targeted questionnaire response.

30.6.1. Historical method

To understand the present market and estimate future market events the investigator must consult statistics of food distribution, sales records, and product turnover rates. These records a reanalyzed and extrapolated to know future trends. Unknown reasons for drop in sales has to be predicated through observational and questionnaire response method in a market situation. Statistical records of the market provide information (to the investigator) about the area, region and population be considered for conducting consumer preference studies.

30.6.2. Observational method

The method requires trained person(s) to observe group behavior of consumers and can gather quantitative and qualitative data on food habits and ways of selection. Hidden observers can watch consumers in super markets to determine whether purchases are planned or impulsive to establish what displays and packaging appeals to them to determine whether certain food items are selected more often by men than by women.

Merchandisers may be interested in knowing the role of background music, product location, lighting or other physical or psychological factors responsible for consumer behavior.

Advertisers and producers are interested in how the consumer appraises the product – does he/she smell it, squeeze it, weigh it, read the label, study instruction, or compare it with other on the shelf.

Expert observers may take help of video-cameras for close observation and hidden microphones to enhance their efficiency. The value of observation method can be enhanced if same consumers are interviewed through questionnaire to find out the difference between ‘activity' and 'response'

30.6.3. Questionnaires

To obtains consumer reaction on a multitude of topics related to selection and use of commodities, carefully worded questionnaires are frequently used the questionnaires may vary from one short question to several hundred inquiries about past, present and future behavior.

The effectiveness of this method depends on:

i. The questionnaire, and

ii. The degree of co-operative spirit elicited from the consumer as well as, the type of approach employed.

The method may be:

i. In – depth interview

ii. Word association

iii. Sentence completion

iv. Projective questioning

v. Role playing

vi. Recorded group discussion and

vii. Pre-test questionnaire.

The most common approaches with the questionnaire method include telephone, mail, personal interview, and public test which have advantages and disadvantages. However, personal interview is most reliable way of obtaining information on food Preferences and it has an advantage of collecting consumers observational data concomitantly. The consumer may be approached in interview after serving the sample to obtain their opinions. At the same time they are also observed for their behavior in buying the product to establish a correlation of degree of liking with buying behaviour.

30.6.4. Types of questionnaires.

i. Opinion questionnaire

When opinions of consumers are sought, the following are the type questions True – false response

i. Yes – no response

ii. One – word answer

iii. Multiple choice

iv. Essay type

a. Why do you _____?

b. What do you think of _____?

c. What would you do if _____?

ii. Selection of questionnaire

The selection of a questionnaire used to judge select experimental food depends on:

i. The number of treatments,

ii. Sensory intensity of the food commodity, and

iii. The information desired.

Following is a list of examples of presentation method suitable for consumer survey purpose: -

I. Single – Sample presentation

a. Acceptable or unacceptable

b. Degree of liking

c. Description (with or without suggested terminology)

d. Numerical scoring.

II. Paired – sample presentation

Identified– product paired comparison in which sample of known quality is compared against sample of unestablished quality.

a. General preference

b. Degree of preference

c. Difference testing

d. Quality scoring or scaling devices

e. Blind paired comparison, in which the quality of neither sample has been established previously.

III. Three sample presentation

a. Triangle test

b. Ranking

c. Quality scoring or numerical scaling

d. Descriptive terms

e. Due– trio

IV. More than three samples.

a. Ranking

b. Scoring or scaling

c. Degree of liking

30.6.5. LIMITATIONSOF CONSUMERS SURVEY

The limitations of consumers surveys are:

i. Expensive,

ii. Time consuming the subject to numerous uncontrollable variables.

Although most survey yield valuable information, investigators experience

many problems and should recognize the limitation of their methods.

The response of consumers, as individuals, or as a group, can easily be under estimated or over estimated.

The following consumers characteristics are encountered in many surveys: -

· Inability to remembers, to generalize, or to identify motives.

· Inability to describe likes, dislikes and attitudes.

· Inability to weigh the numerous alternatives.

· Unawareness of what influenced their behavior.

· Awareness of more factors than the impact of influence warrants.

· Desire to please the interrogator.

· Desire for social status, prestige, and keeping up with the Joneses.

However, by correct wording of questionnaire most of the above traits can be avoided or diminished. Collaborative studies between food technologists, economists, psychologist and statisticians must be conducted for making consumer behavior more predictable

*****☺*****

Module 12. Objective methods for sensory evaluation and milk products with defect

Lesson 31. Interrelationship between sensory properties of dairy products with instrumental and physic chemical tests

31.1INTRODUCTION

The texture properties of dairy products are that group of physical characteristics which are sensed by the feeling of touch and are related to the deformation, disintegration and flow of the product under application of force. While the subjective measurement of sensory properties is a limitation accomplished by the use of sense of touch or feel by the human hand and mouth, the objective measurements refer to measurement of the properties only indirectly. Despite certain limitations such as high cost, skilled operation, calibration of instruments the instrumental approach remains superior to subjective measurements as it offers sensitivity, reproducibility and versatility.

31.2TEXTURE AND ITS INSTRUMENTAL PROFILES:

The textural properties of dairy products are greatly influenced by the internal structure, composition (protein, total solids), size and shape, and their interrelationships. It is, therefore, not possible to obtain an overall index of these properties in a single measurement.

Objective measurements of texture generally measure force of work or both which are functions of mass, time and deformation. The following textural profile properties are often measured in modern texture analyses:

a. Hardness

The force necessary to attain a given deformation (peak force during the first compression cycle)

b. Cohesiveness

Threat of disintegration under compression strength (ratio of positive area during the second compression to that of first compression)

c. Adhesiveness

The work necessary to overcome the attractive forces between the surface of the food and other surface of contact (negative peak area for the first cycled compression)

d. Elasticity

The rate at which a deformed material goes back to its under for med condition, after the deforming for ceis removed. (The height that the food recovers during the time that elapses between the end of the first bite and start of the second bite)

e. Gumminess

The energy required to disintegrate a semi-solid food product to as Tate ready for swallowing (hardness & cohesiveness)

f. Chewiness

The energy required to masticate a solid food product toast ate ready for swallowing (gumminess x springiness)

31.3 TYPES OFTEXTURE INSTRUMENTS

There are wide range of instruments are available for measuring texture properties of dairy and food products. Some of the important equipment are described below:

1.Wire Cutting Devices: A wire drive nata constant speed to cut the sample is used for certa in dairy products. An advantage is that the sample area in contact with the wire f is used in dairy industry to measure the curd tension of milk and fermented products like curd, yoghurt, cottage cheese etc. A circular blade is driven at a constant speed to cut the curd. It is characterized by a product supply carriage, into which the guide for the material to be cut, the feed device and means for holding the material to be cut are integrated and can be switched over between operating position and a retracted position by means of an actuating unit. Thus permitting the product to be guided right-up to the immediate vicinity of the cutting knife.

2. **Cone Penetrometer:** It consists of a cone of varying dimensions which is allowed to penetrate under constant conditions in chhana, paneer, khoa or any other soft dairy product. The hardness values are read out on a mechanical linked graduate scale in terms of one tenth of mm penetration.

Fig. 31.1 Cone Penetrometer

3. Pea Tenderometer: It consists of a grid of shearing blades (test cell) rotate dat constant speed through a second grid suspended, so that the force on these cond grid is counter balanced by a pendulum which is displayed by a pointeron a graduated scale. It is widely used by the pea industry.

4.Warner – Bratzler Shear Tester:

In this tester, a cylindrical sample usually 2.5 cm. in diameter is placed in a triangular hole in a thin blade of0.25cm. thickness cut by pulling the blade through a slot and the shear for ceindicated by a spring scale. It is widely used for meat products.

5. Kramer Shear Press

Kramer shear Press consists of a hydraulic press where the ram speed can be selected to complete its down stroke in 15 to 100 seconds. The ram operated by a hydraulic pump drives the moving components of the texture test cell into stationary components supported by the press frame. It is based on the principle of a multi – blade shear compression cell. The instrumental does not give precise and accurate reading of force exerted because of its limitation of control by ram speed.

6. **Instron Universal Testing Machine.**

The Instron Universal Testing machine (Fig.31.2). is an instrument for measuring texture through tension and compression testing within the force range of less than 1N to 5kN. It is a very important and versatile instrument for application in research, development and quality control laboratories. It comprises of a standard load frame and drive unit, a load weighing system and a microprocessor-based control system. A beam carrying a load cell (moving cross head) is located between the based unit and the fixed crosshead at the top of the frame. The crosshead moving in vertical direction at a selected speed is supported and driven by two lead screws. It contains a force sensing and recording system which measures the force during the test and transmits them to a strip chart recorder. This Instrument can be programmed for automatic return, cycling and relaxation test etc.

Fig.31.2 The Instron Universal Testing machine

7. The Ottawa Texture Measuring System

The Ottawa Texture Measuring machine is like the Instron Machine in design and operation except that it uses a single screw as drive instead of twin screws. The Ottawa cell consists of a rectangular metal box containing 8 or 9 thin stainless-steel rods. The sample is compressed by a plunger and sheared and extruded through a wire – grid. If offers operational flexibility for research and quality control laboratories. It uses modern electronic system to record force, deformation and time precisely.

8. General Foods Tetrameter

The principle involve in the instrument is imitation of the chewing action of the mouth for mastication of foods. The chewing forces are detected by strain gauges with the help of a position transducer and displayed on an oscilloscope. This helps ascertain the force required for teeth penetration into the food, thus reflecting the food texture. Fig. 31.2 is for general foods texture analyzer

Fig.31.3 Foods Texture Analyzer (Click for animation)

9. The Stretch meter:

The instrument is used for the measurement of stretch ability of Mozzarella

cheese

Fig.31.4 Stretch Tester

10. Other Instruments

The curd tension, curd firmness, consistency/viscosity (Fig.31.4) of cheese etc. Can be determined by various techniques especially milk curd – meter, containing a star shaped knife attached to a balance. Other texture measuring devices employed for milk products include ball and needle penetrometers, extenders, melographs etc.

Fig.31.5 Viscometer

Module 12. Objective methods for sensory evaluation and milk products with defect

Lesson 32. Preparation of milk and milk products with defects, techniques for simulation.

32.1 INTRODUCTION

The students as well as panel members can be trained by providing the defective samples of milk and milk product to make them acquainted. Therefore, it is necessary to know the techniques for the preparation or simulation of defects in samples of milk and milk products.

The techniques are provided to prepare the defects in some of the milk and milk products like ice-cream, butter, cottage cheese, etc.

32.2. PREPARATIONOF DEFECTIVE SAMPLES IN MILK

32.2.1. Acidic or sour milk:

1. Add about 2% volume of cultured buttermilk to fresh milk or

2. Add 6–7ml of a 10% lactic acid solution to the milk.

32.2.2. Bitter:

1. Add 2–2.5ml of a 0.1% quinine sulfate solution to _ 600ml of milk, which

will yield milk with a bitter off-taste within the range of ‘‘pronounced.’’

32.2.3. Cooked flavour:

A cooked flavor may be produced by heating working quantity of milk in a vessel to 80C (176F) and holding for 15 min. Be aware that elements of the cooked attribute are volatile and will evaporate shortly after the container is opened.

32.2.4. Feed:

Adding 4–7ml of a prepared ‘‘tea’ to600ml of milk will impart a pronounced feed flavor upon the milk. An expanded intensity range is a result of variability in the strength

quantity of the tea.

32.2.5. Flat:

Add about 20% water to 2% milk.

32.2.6. Foreign/chemical:

1. Add about 2ml of a 200-ppm chlorine solution to 600ml of milk immediately before presenting to the student. This off-flavor does not remain ‘‘stable,’’ so it can be prepared freshly.

32.2.7. Fruity/fermented:

1. The fruity/fermented defect can be closely approximated by using a mixture of six parts pineapple juice and one-part vinegar. Add 3–4ml of this mixture to 600mlof milk to yield a pronounced defect. Or

2. Add 1ml of a 1% stock solution of food grade ethyl hexanoate to600ml of milk.

32.2.8. Garlic/onion:

1. Add 2ml of a 1% garlic powder mix (in water) to the milk. Or

2. Add a clove of garlic to infuse for about2 h; then either decant the milk or retrieve the clove.

32.2.9. Lacks freshness:

1. Open a carton of milk and store in the refrigerator for _ 7 days, or

2. Use an unopened carton of milk that is 1 week beyond the pull date. Or

3. Add 10–15 g of skim milk powder to600mL of milk.

32.2.10. Light oxidized:

1. Exposing milk in transparent and/or translucent plastic jugs to fluorescent lighting will quickly produce light-oxidized milk. or

2. Milk can be transferred into a clear glass milk bottle and placed on a windowsill

exposed to direct, bright sunlight for the 5–7 min, 9–10 min and 13–15 min to get slight intensity definite and pronounced oxidized flavour.

32.2.11. Metal oxidized:

1.Immerse a copper penny or a copperware in milk overnight.

2. Add one or two drops of a 1%solution of copper sulfate to 600ml of milk and leave in a refrigerator for about 8 h.

32.2.12. Salty:

Dissolve 0.25 – 0.5 g of table salt into 600mL of milk.

32.2.13. Unclean (Spoiled):

1. Combine rancid, fruity, and bitter milks Or

2. Most commercial milks will eventually become naturally ‘‘spoiled’’ or unclean ($\geq$7–10days beyond sell by date).

32.2.14. Rancid:

1. Add0.5g of lipase power to ~600mL of milk, agitate and hold at 21 ° C (70 ° F) for an hour. or

2. Add ~ 20 mg lipase to the same volume of milk and store at refrigerator temperature for ~ 48h. Or

3.Add few drops of a dilute solution of butyric acid to ~ 600ml milk base.

32.3. PREPARATION OF DEFECTIVE SAMPLES INBUTTER

32.3.1. Garlic

Store a sample of butter in a closed container with a clove of garlic for 6h.

32.3.2. Musty

Store the butter in a closed container aside an agar slant of the yeast microorganism Streptomyces odoriferous

32.3.3. Onion Remove the garlic, re-close the container and refrigerate the butter and allow time for the onion aroma to penetrate the butter's center mass

32.3.4. Oxidized:

Store in a refrigerator aliquot sticks of butter lightly wrapped in paper, ranging from several weeks to a month. The surface of the butter will undergo oxidization and the distinct off-flavor will, in time, diffuse into the butter's interior, although most of the

oxidized flavor will be surface concentrated

32.3.5. Storage:

1. Select grocery store ''house brand'' butters to either refrigerate for 4–6 months or frozen for 8–12þ months, and then examine for a range of storage-like flavors. Or

2. Store the butter in a rarely cleaned refrigerator for a few weeks until enough of the aroma has penetrate to emulate this butter off-flavor.

32.2.6. Rancid:

1. Place stick of butter in a closed container with a small jar containing butyric acid for about 6 h. Remove the butyric acid, re-seal the container and permit the butyric acid to equilibrate throughout the butter for a week or more. Or

2. Store the butter for a few days in an enclosed container with a slice of Romano or blue cheese.

32.3. PREPARATION OF DEFECTIVE SAMPLES INICECREAM

32.3.1. Acidic/Sour:

Add 10ml of buttermilk to 200ml of the basic mix

Cooked:

Heat basic mix in a double boiler to 80^0C(176^0F) for 15 min. Filter if any particles or chunks result.

High flavor:

Add 1ml vanilla extract to 200ml of basic mix

High sweetness:

Add 5 g of sugar to 200ml of basic mix

Low sweetness:

Use the basic mix to illustrate

Lack fine flavor:

Add 25ml whole milk to 200ml basic mix.

Low flavoring:

Use the basic mix.

Oxidized:

The metal oxidized variant is called for, so utilize metal oxidized milk or cream as the base.

Salty:

Add 1 g of table salt to 200ml basic mix.

Whey:

Add 10 g of whey powder to 200ml basic mix.

32.5 PREPARATION OF DEFECTIVESAMPLES IN COTTAGE CHEESE

Bitter:

Add 2–3ml 0.1% quinine sulfate to paint of cottage cheese to get a pronounced bitter flavor.

Cooked:

Heat ingredients to be used for dressing to 80^0C (176^0F) for 15 min in a double boiler.

Fruity /fermented:

The fruity/fermented defect can be closely approximated by using a mixture of six parts pineapple juice and one-part vinegar. Add 3–4ml of this mixture per pint of cottage cheese.

Acidic/Sour:

1.Add approximately 2% buttermilk to a pint of cottage cheese. Or

2. Titrate cottage cheese to the desired acidity by using a 10% lactic acid solution.

Rancid:

1. Treat cottage cheese with 0.5 g of lipase per pint and allow to react at room

temperature for an hour or in the refrigerator for 24–48 h. Or

2. Finely ground Romano or Kasseri cheese can be incorporated into the cheese sample to simulate rancidity.

Salty:

Add 0.5 g of table salt per pint.

Unclean (spoilage):

1. Store commercial cottage cheese samples for 7–14 days beyond the sell by date Or.

2. Blend bitter, fruity/fermented, and rancid samples together.

Yeasty:

Add baker's yeast to cream dressing and hold at room temperature overnight, and then add the ''treated' 'dressing to dry cottage cheese curds.

Whey:

1. Acquire sweet liquid whey from a hard cheese manufacturer and use to ''doctor'' cottage cheese samples ''to taste. 'Or

2. Add reconstituted (1:9 dilution) whey powder to achieve the desired whey flavor intensity.

*****☺*****