JUDGING OF DAIRY PRODUCTS

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

Lesson 8

CLASSIFICATION OF TASTES AND ODOUR, THRESHOLD VALUE AND ITS DETERMINATION

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 play a 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.

- The sugar to acid ratio -important role in fruits.
- Alkaline taste -attributed to OH ions, an irritating effect on general nerves endings in the mouth.
- Astringency -not taste but aspect of flavor, Borax is known for its astringency.
- Coolness -Characteristic of menthol, a part of mint flavor complex.

- Hotness -associated with spices, also known as pungency, non-volatile amides are responsible for heat effects.
- 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 saccharin-intense sweet -gives metallic after taste. It is frequently associated with oxidized products. 'Oct-1-en-3-one' -responsible for metallic flavor in dairy products.
- A drug 'gymneric acid' -renders taste bud insensitive to sweet & bitter, but no to salt and sour.
- A berry grown in Africa, known as 'miracle fruit' when eaten sour food (lemon) - tastes sweet. The active substance coats the taste buds.
- Salts reduces sourness of acids, certain acids increases saltiness.
- Salt on one side of tongue, cause distilled water on other side to taste sweet or insipid i (tasteless). .
- 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

Characteristic	Defect	Degree of defect		
		Suspicion	Definite	Pronounced
(1)	(2)	(3)	(4)	(5)
Package appearance	Improper seal/ rust spot/ soiled/ dull surface	1	2	3
Colour and appearnce	Browning	1	2	3
	Mould Buttons	2	5	10
	Fat separation	1	3	5
Body and Texture	Thickened	2	10	16
	Sandy/coarse/ mealy/ heavy	2	5	10
	Settled	1	2	3
Flavour	Caramalized	1	2	5
	Rancid/ tallowy	2	4	8
	Metallic	2	5	10
	Fruitiness	2	5	10

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, 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 Odor 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

Score	Grade
90 and above	Excellent
80 -89	Good
60-79	Fair
59 and below	Poor

8.6 Factors affecting threshold

There are several factors which affecting the threshold. These are

1. Purity of compounds: purity is necessary for threshold tests.

2. 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.

3. Effect of Hunger and Chemicals: increase in sensitivity during morning and a rapid decrease after a meal. Alcohol and sugar decrease olfactory sensitivity.

4. 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

Olfactometery

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)

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