Paper 01: Food Chemistry

Module 30: Food flavours-1: Threshold value, aroma value and taste substances

Introduction

Flavour, an important part of food quality, has a complex sensory basis involving receptors in both the oral and nasal cavities includes cells, sensitive not only to taste and odour but also to pressure, touch, stretch, temperature and pain. May be denoted as the sum of characteristics of the material (food), produce that sensation. Their relative contributions to flavour may vary widely even for apparently similar substances. So it is a property of a material (a food) as well as of receptor mechanism of the person eating or drinking the food. Study of flavour includes composition of foods in terms of compounds having taste or smell and their interaction with the receptors in the taste and smell organs. Following the interaction, signals are produced which are carry to the central nervous system of brain to create the impression of a flavour. Except flavour there are other qualities continuing to the overall sensation. For example, texture like smoothness, roughness, granularity, viscosity also has a definite influence on flavour. In addition to this, there are other factors such as hotness of spices, coolness of menthol, brothiness or fullness of certain amino acids etc. also contribute to complete the term 'flavour'.

FLAVOUR

According to Amerine *et al*. (1965) flavour has been defined as the sum of perceptions resulting from stimulation of sense ends that are grouped together at the entrance of the alimentary and respiratory tracts. Generally for practical sensory analysis the term restricted to the impression perceived via the chemical senses from a product in the mouth. Flavour includes:

- Aromatics, olfactory perceptions caused by volatile substances released from a product in the mouth via the posterior nares
- Tastes, gustatory perception(sweet, salty, sour bitter) caused by soluble substances in the mouth

- Chemical feeling factors that stimulate nerve ends in the soft membranes of the buccal and nasal cavities (astringency, spice heat, cooling, bite, metallic flavour, umami taste)

Flavour reaction

Flavour reaction is used for biochemical characterization of flavour compounds. Flavour- active chemicals + human → flavour response

It is simple in nature but represents a complex series of unknown biochemical events. Three things of flavour reaction that affect the work of flavour chemists are the following

1. Flavour reaction comes in different qualities or modalities
2. Shows a sigmoid dose- response curve
3. Responses are characterized by inhibition and suppression and not by synergy (Acree, 1993)

Flavour unit

Flavour unit is commonly used as a method of assessing the flavour activity of chemicals in mixtures.

Flavour activity = [1/ (threshold)] × [concentration]

Activity is thus linear with respect to concentration or some function of concentration. The concentration factor is the amount of compound detected in or added to a food.

THRESHOLD VALUE

The concept of odour unit or flavour unit used the threshold as a measure of flavour intensity. Odor threshold value (OTV) (also aroma threshold value (ATV), Flavor threshold) is defined as the most minimal concentration of a substance that can be detected by a human nose. According to the American Society for Testing and Materials (ASTM) definition of threshold concept for the chemical senses: "A concentration range exists below which the odor or taste of a substance will not be detectable under any practical circumstances, and above which individuals with a normal sense of smell or taste would readily detect the presence of the substance." There are four types of thresholds namely detection, recognition, difference, and terminal but only detection and difference threshold can be measured with sufficient objectivity to be reliable measures.

Detection threshold (Absolute threshold) - The threshold for a particular taste or smell is the lowest concentration of a compound that a panelist can distinguish from water (or other solvent). At and above this concentration, the panelist will indicate that a compound is present, while below this concentration the panelist will indicate there is no compound present.

Recognition threshold - 'The British Standards Institution' defined it as the lowest concentration at which a substance is correctly identified. Typically, this level is higher than the detection threshold for the same stimulus.

Difference threshold - 'The British Standard Institution' defined as the smallest change in concentrations of a substance required to give a perceptible change. The amount of change needed is often referred to as the **just-noticeable difference** or **"jnd."** It is quite similar to the detection threshold, but instead of looking for the lowest intensity that can elicit a sensation, one is determining the lowest increase in stimulation from some base intensity that can elicit a change in sensation.

This phenomenon is described by Weber's law, which states that the difference threshold divided by the baseline intensity remains constant. Difference thresholds change with stimulus intensity in a predictable way, or stated mathematically

Weber's law: C=C ¼ k;

Where, C is the absolute intensity of the stimulus, k is a constant (usually between 0 and 1), and C is the change in intensity of the stimulus that is necessary for 1 jnd.

Terminal threshold- 'The British Standards Institution' defined as the concentrations of a substance above which changes in concentration are not perceptible. If the stimulus is increased in intensity beyond the level of terminal threshold pain occurs. For example, a solution of sodium chloride can become so concentrated that when it is sipped it not only elicits the sensation of saltiness, but also sensations of burning and/or stinging. The terminal threshold would be the highest concentration of sodium chloride above which there is no increased saltiness, only increased burning and stinging.

Recently, a new type of threshold has been proposed for rejection of a taint or off-flavour by consumer. Prescott *et al*. (2005) defined the **rejection threshold** as the concentration at which there was a statistically significant preference for an untainted sample.

Threshold in a food is dependent upon:

- The threshold of the aroma in air.
- Concentration in the food
- Solubility in oil and water
- Partition coefficient between the air and the food
- The pH of the food, some aroma compounds are affected by the pH - weak organic acids are protonated at low pH making them less soluble and hence more volatile.

Determination of threshold

Threshold can be determined by a number of classical threshold designs namely, Method of limits, Method of average error, Frequency method (Kling and Riggs, 1971). Earlier psychophysicists used the method of limits as a most common approach for measuring thresholds. But current trends follow Signal detection theory or SDT. This design based on the size of psychological difference between the two stimuli known as d'. SDT is advantageous as the subject's decision process is more explicit and can be modeled statistically but more time consuming than classical threshold designs. Forced choice method of sample presentation shows 1:1 relationship between d' and the classical thresholds method. Due to this ASTM (1976, 1990) and International Standard Organization (1999) preferred the 3 Alternative Forced Choice (3-AFC) method based on Method of limits.

In Method of limits, stimulus intensity would be raised in an ascending series and then lowered in a descending series to find points at which the observer's response changed from a negative to a positive response or from positive to negative. Over several ascending and descending runs, an average changing point could be taken as the best estimate of threshold (McBurney and Collings, 1977). This method is illustrated in Fig. 1

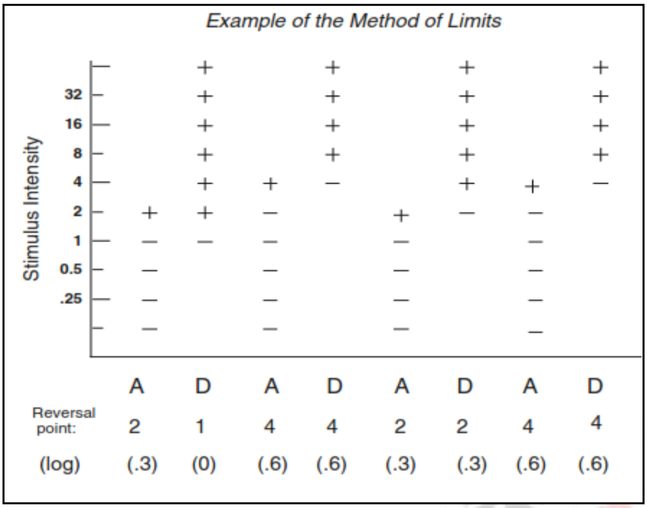


Fig 1. Method of limits example

<u>Disadvantage</u>

1. Descending series may cause fatigue or sensory adaptation to the observer for detecting stimulus presentations. For this the method is usually performed only in an ascending series.
2. Amount of sensation required before changing the response is dependent on individual. Thus the classical method of limits is contaminated by the panelist's individual bias or criterion which is a central issue in the theory of signal detection.

To eliminate these psychophysicists introduced a forced choice element to the trials at each intensity level or concentration step. A forced choice technique is compatible with signal detection principles and is bias free, since the observer does not choose whether or not to respond—response is required on each trial.

Suggested Method for Taste/Odor/Flavor Detection Thresholds

<u>Ascending Forced-Choice Method of Limits</u>

Ascending Forced-Choice Method of Limits procedure is based on a standard method designated by ASTM E-679 (ASTM, 2008a). It follows the classical method of limits. In this procedure three samples are presented where two are controls and the rest one contains the substance under test. The stimulus or product with the taste or odor substance is called a “target” and the other items with no added substance are often referred to as “blanks.” So the task is a three-alternative forced choice task (3-AFC), as the person being tested is forced to choose the one different sample in the set of three.

Purpose of the Test - To find the minimum level of concentration of a substance that is detected by 50% of the sample group. In practice, this is calculated as the geometric mean of the individual threshold estimates.

Preliminary task before threshold testing

1. Test compound of known purity is taken (source and lot number)
2. Choose and obtain the solvent, carrier, or food/beverage system
3. Set concentration/dilution steps, e.g., 1/3, 1/9, 1/27
4. Begin benchtop screening to bracket/approximate threshold range
5. Choose number of dilution steps
6. Recruit/screen panelists. N = 25 is desirable
7. Establish procedure and pilot test if possible
8. Write verbatim instructions for panelist

Ascending forced-choice testing steps

1. Obtain randomized or counterbalanced orders via software program or random number generator.
2. Setup trays or other staging arrangements for each participant, based on random orders.
3. Instruct participants in procedure per verbatim script developed earlier.
4. Show suprathreshold example (optional).
5. Present samples and record results. Force a choice if participant is unsure.
6. Tally results for panel as series of correct/incorrect answers.
7. Calculate estimated individual thresholds: Geometric mean of first correct answer with all higher concentrations correct and last incorrect step.
8. Take geometric mean of all individual threshold estimates to get group threshold value.
9. Plot graphic results of proportion correct against log concentration. Interpolate 66.6% correct point and drop line to concentration axis to get another estimate of threshold (optional).

10. Plot upper and lower confidence interval envelopes based on ±1.96(p (1–p)/N). Drop lines from the upper and lower envelopes at 66.6% to concentration axis to convert envelope to concentration interval.

Alternative Methods:

-Rated Difference,

-Adaptive Procedures,

-Scaling etc.

AROMA VALUE

Aroma substances are volatile in nature, perceived by the odor receptors, the olfactory tissues of the nasal cavity. Aroma compound is essentially associated to a typical odor or taste for a particular food, while results off- flavour in another food. The lowest concentration of a compound that can still be directly recognized by its odor is designated as an aroma threshold value (ATV) or odor threshold. Threshold concentrations of aroma compounds are dependent on their vapour pressure, assay procedure and/or performance of sensory panel.

Compound	Threshold value (mg/l)
Pyrazine	300.00
Ethanol	100.00
Maltol	35.00
Hexanol	0.7
Butyric acid	0.2
Vanillin	0.02
Limonene	0.01
Linalool	0.006
Hexanal	0.0045
2- Phenylethanal	0.004
α-Ionone	0.004
2-Methylpropanal	0.001
Ethylbutyrate	0.001
(+)-Nootkatone	0.001

(-)-Nootkatone	1.0
2-Methylbutyric acid ethyl ester	0.0001
4-Hydroxy-2,5-dimethyl-3(2H)-furanone	0.00004
4-Methoxy-2,5-dimethyl-3(2H)-furanone	0.00003
Methylmercaptan	0.00002
β-Damascone	0.000009
β-Ionone	0.000007
2-Isobutyl-3-methylpyrazine	0.000002
1-p-Menthen-8-thiol	0.00000002

Table 1. Odour threshold values of some aroma compounds in water at 20˚C

The amount of volatile substances in food is very low, generally ranging from 1 to 50 mg/kg. To perceive of an aroma substances, a component of volatile fraction should be present in food in a higher concentration than threshold value. The important aroma constituents are those responsible for characteristic aroma of the food. Depending on the "character impact compound" food can be divided into four groups.

Group 1: Aroma is decisively carried by one compound. The presence of other aroma compounds round off the characteristic aroma of the food.

Group 2: One of several compounds plays a major role to create the typical aroma of the food.

Group 3: aroma may be closely simulated or reproduced with a large number of compounds not present.

Group 4: food aroma cannot be reproduced even with a large number of volatile compounds.

Loss of "Impact compounds" or shift in aroma concentration or a change in composition of the components may cause aroma defect or off-flavour. Off- odour can be detected by modern analytical instruments which are essentially rapid and extensive. These instruments also correlate between the amounts of specific compounds and the sensory quality. Some common off- flavour that produce during food processing and/ or storage are given in Table 2.

Food products	Off-flavour
Milk	Sunlight flavour
Milk fat	Metallic
Mutton- meat	Sweet, acidic
Peas- deep frozen	Hay like
Orange juice	Grape note, terpene note
Beer	Sunlight note, phenolic note

Table 2. Off-flavour in food products

TASTE SUBSTANCES

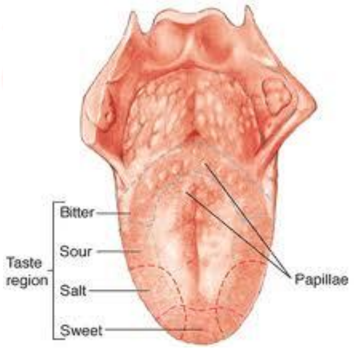
'Taste' means not only sensory response to soluble materials on mouth but also esthetic appreciation. Three different approaches for sensing taste includes behavioral, electrophysiological and molecular. Behavioral responses provide useful information on palatability. Electrophysiological studies give the nature of gustatory process. Whereas, molecular approach is still in their infancy. Salivary glands play an important role by dissolving or diluting taste substances and carrying them to receptors. Saliva and buffer acids help in controlling temperature. Among the three pairs of salivary glands parotid saliva is watery and has high digestive power. The other two gland secretions are viscous and higher in mucin. High potassium content acts as a sensitizer of taste receptors. The high thiocyanate ion present in saliva increases the threshold for sweet whereas, decreases for bitter (Ehrenberg and Gunttes, 1949).

The tongue serves as the major taste organ as it brings the taste substances into contact with the taste buds. The tongue movement also disturbed concentration near the receptor. The raised portions on the tongue, papillae are considered as taste receptors (Boring, 1942). The tongue is insensitive to taste in the regions where there are no papillae. Gustatory (taste) sensibility is mainly confined to the tip and edges of the tongue and absent in middle of the tongue.

Four kinds of papillae are found on the human tongue. These are foliate, circumvallate, fungiform, and filliform. Numerous filliform papillae are evenly distributed on the anterior 2/3 of the tongue but have no taste buds. Fungi form papillae, large and round and mushroom-like in appearance are large at the tip and sides of the tongue. Foliate papillae are found on the posterior 1/3 of the tongue, usually in folds on the sides. These are also not well developed in man and have little function. Large numbers of “V-shape” circumvallate papillae are situated on the back of the tongue.

Generally in human, taste buds are located on moist surfaces within the oral cavity and pharynx .A few non-papillae associated taste buds may also be found in such locations includes soft palate, pharynx and larynx. When a taste bud is exposed to the taste stimulus, strong taste signals are transmitted by taste nerves into the central nervous system and finally taste reflexes are integrated into the brain stem directly into superior and inferior nuclei. Excretion of saliva is controlled during ingestion of food by the transmission of these impulses to the salivary glands.

Taste perception: Taste buds differ in their response to stimuli. The four basic taste solutions are perceived by different regions of the tongue namely



-Sour taste may perceive chiefly along the sides of the tongue.

-Saltiness is along the sides and tip.

-Sweet taste is generally at the tip.

-Bitter taste perceived at the base of the tongue.

Fig 2. Tongue showing different taste regions.

Classification of taste:

There are large numbers of distinct tastes but practically they are only combination of four basic tastes. According to Skramlik (1921), the inorganic salt solutions with multiple tastes i.e. sweet, sour, salty and bitter could be duplicated by suitable mixture of sucrose, tartaric acid, sodium chloride and quinine.

Sweet taste: Nonionized aliphatic compounds like alcohol (glycerol), salts (lead acetate), sugars, complex aromatics (saccharine), organometallic compounds (cyclamates), aldehyde (cinnamic aldehyde) etc. elicit sweet sensation. Not all sugars are equally sweet. The most intensely sweet taste is produced by fructose followed by sucrose, galactose and lactose. Sweet sensation is associated with hydroxyl (-OH) radicals on the sugar molecules. In some sugars –OH groups are not available to elicit sweet taste as they are bound together by H bonds. Sweetness is particularly important in soft drinks, fruits and fruit juices, in honey and in many baked foods. Many investigators have attempted to relate the chemical structure of sweet tasting compounds to the taste effect and a series of theories have been proposed. One of these called AH,B theory. According to this theory a sweetener must contain a hydrogen bond donor (AH) and a Lewis base(B). AH-B unit of sweetener binds with a corresponding AH-B unit on the biological sweetness receptor to produce the sensation of sweetness. As the molecular weight of saccharides increases there is a decrease in sweetness. Because only one sugar residue in each oligosaccharide is involved in the interaction at the taste bud receptor site.

Compounds	Relative Sweetness
Sucrose	1.0
Lactose	0.27
Maltose	0.5
Sorbitol	0.5
Galactose	0.6
Glucose	0.5 to 0.7
Glycerol	0.8
Fructose/ Labulose	1.1 to1.5
Cyclamate	30 to 80
Aspertame	100 to 200
Stevioside	300
Saccharine	500 to 700

Table 3. Relative sweetness of sugar and other sweeteners

Relative sweetness of mixture of sugar changes with the concentration of the components. Synergistic effects may increase the sweetness by as much as 20- 30% in such mixtures. Sweetening agents used in food are toxic on long use and can be considered health hazardous.

<u>Sour taste:</u> Sourness or the tart taste of acids plays an important role in fruits and fruit juices, fermented products etc. Lack of certain amount of acidity results flat and unpalatable taste in many foods. Although it is generally recognized that sour taste is the property of hydrogen ions but there is no simple relation between sour taste and acid. Sourness in mouth may depend on the nature of the acid group, pH, titratable acidity, buffering effect, and presence of other compounds specially sugars. Organic acids compared with inorganic acids have greater taste effect such as 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. Also, weak acids, taste more acid than they are. This is due to the buffering action of saliva.

Relative sourness in a buffer solution of acid is not a function of molarity but it is proportional to the amount of phosphate buffer required to bring the pH 4.4. Citric acid was judged most sour, fumeric acid and tartaric acid were equal and edipic acid was least sour. But the taste of citric acid and tartaric acid were preferred over those of fumeric and edipic acid. Partial neutralized acids taste more sour than the pure acids containing the same amount of undissociated acids.

<u>Salty taste:</u> Salt taste is best exhibited by sodium chloride. It is sometimes claimed that the taste of salt by itself is unpleasant and main purpose salt as a food component is to act as a flavour enhancer or flavour potentiator. Saltiness is associated to the ions present in salts. Table salt is mostly used in foods. The taste of salt is depended on the nature of both cation (Na+) and anion (Cl-). As the molecular weight of either cation/anion/both increases, the salts are perceived to taste bitter. KCl and $CaCl_2$ have a salty taste, but different from NaCl. The 'differences' may depend partially on other sensations like bitterness, feel, sweetness etc. The lead and beryllium salts of acetic acid have a sweet taste but are extremely toxic. The taste sensations of various salts are given below.

Taste	**Salts**

Salty	LiCl, NaCl, KCl, LiI,NaI, $NaNO_3$, KNO_3.
Salty and bitter	KBr, NH_4I.
Bitter	CsCl, CsBr, KI, $MgSO_4$.
Sweet	$(CH_3COO)_2Pb$, $Be_4O(O_2CCH_3)_6$

Table 4. Taste sensation of different salts

Bitter taste: Bitter taste is widely distributed and can be attributed to a great variety of inorganic & organic compounds. Many substances of plant origin are bitter. The bitter taste is also predominant in beer, wines, and in some foods. Alkaloids (basic N containing organic compounds) like caffeine, theobromine, nicotine, and quinine are bitter. Glycosides of phenolic compounds, 'Naringin' in grape fruit, inorganic salts include CsCI, CsBr, KI, and MgSO4 are also bitter in taste. Naringin in pure form is more bitter than quinine and can be detected in concentration of less than 0.002%. Amino acids like phenylalanine, leucine, valine, and histidine are bitter in nature. Bitter peptides are formed by partial enzyme hydrolysis of proteins for example cheese ripening. Due to the unpleasant taste bitter compound is usually used in combination with sweet and sour. Quinine is often used as a standard for bitter taste. The bitterness of quinine hydrochloride is detectable in a solution as dilute as 0.00004 molar or 0.0016%. The order of sensitivity is bitter, sour, salty and sweet with threshold values for bitter- 0.0016% quinine hydrochloride, sour- 0.007% HCl, salt- 0.25% NaCl, sweet- 0.5% sucrose. If artificial sweetener such as saccharine is considered, the sweet sensitivity is second to bitter.

Other aspects of taste: The basic taste sensations like sweet, sour, salt and bitter account for the major part of the taste response. However, it is generally agreed that these basic tastes alone are not sufficient for the complete description of taste.

Interrelationship between sweet and sour is very important in many foods. Sugar to acid ratio play an important role in the flavour quality of fruit juices and wines.

Alkaline taste is attributed to -OH ions. Caustic compounds can be detected in solutions containing only 0.01% of the alkali. It generates an irritating effect on nerves endings in the mouth.

Astringency is not a taste but must be considered as a part of flavour and also very difficult to describe. Borax is known for the ability to produce this effect as are the tannins, occurs in foods specially in tea.

Coolness is the characteristic of menthol. The coolness of menthol is exhibited only by some of the possible isomeric forms. Only levo (-) and dextro (+) show the cooling effect, former to a higher degree than the latter. But the isomers like isomenthol, neomenthol and neo-iso menthol do not produce any cooling effect.

Hotness or pungency is associated with spices like chilli, ginger etc. The major compound responsible for the hotness in pepper is pepperin. Non-volatile amides are responsible for heat effects in red pepper or capsicum. Heat effect of spices can be measured by an organoleptic threshold method and expressed as heat unit.

Salts of metals like Hg, Ag, Fe, Cu, and tin are responsible for metallic taste. Practically there is no receptor site for metallic taste, observed over a wide area of the tongue surface, appears to be modality of common chemical senses like irritation & pain. Threshold concentration is in the range of 20-30 ppm of the metal ion. Lead salt of saccharin is intensely sweet but gives metallic after taste. It is frequently associated with oxidized products.

‘Gymneric acid' suppresses sweet & bitter taste whereas, no such effects on salt and sour.

Salts reduce sourness of acids whereas sprinkling of salt on fruit increases the apparent sweetness of sucrose. On the other hand certain acids increase saltiness.

Taste inhibition and taste modification

Substances have been discovered, able to change the perception of taste qualities. The two substances of such compounds, both obtained from tropical plants are gymnemagenin, able to suppress the ability to taste sweetness and the taste modifying protein from miracle fruit (*Synsepulam dulcificum)* which changes the perception of sour and sweet.

Leaves of tropical plant *Gymnema sylvestre* when chewed or masticated, make the ability to taste sweet disappear. The effect lasts for hours and the sweet appears like sand in the mouth. The taste of other sweeteners such as saccharine is equally suppressed. There is also a decrease in the ability to taste bitterness.

The berries of West African shrub (*Synsepulam dulcificum)* contain a substance which has the ability to make some sour substance to taste sweet. The berry known as miracle fruit contains a taste modifying protein. The protein is a basic lipoprotein with a molecular weight of 44000 Dalton. It is suggested that the protein bind to the receptor membrane near the sweet receptor site. This taste modifying protein was found to contain 6.7% arabinose and xylose.

Flavour enhancer: A group of compounds exist which have the ability to enhance or improve the flavour of foods without by themselves having any particular flavour. It has been suggested that normal salt is of this type. The best known flavour enhancer is monosodium glutamate (MSG). Glutamate may exist in L or D form. L form is the naturally occurring isomer and has flavour enhancing property. Whereas, D- form has no activity. MSG derived or produced from wheat gluten, beet sugar waste and soy protein. The protein is hydrolyzed by hydrochloride acid and the neutralized hydrolysate is used in the form of liquid or dry powder.

The flavour effect of glutamate is difficult to describe. It has a meaty or chicken taste but the flavour of glutamate is unique and has no similarity with meat. Pure MSG is detectable with concentration as low as 0.03% and 0.05%. The taste is very strong and does not increase at higher concentration. The taste has been described as the mixture of four tastes. Glutamate may cause a tingling feeling also. The presence of salt is required to produce glutamate effect. Glutamate taste is more effective in the pH range between 6 and 8 and decrease at lower pH values. MSG improves the flavour of many foods like processed meat, poultry, soup, vegetables and sea foods etc.

Recently it has been discovered that the compounds 5'-nucleotide, 5'-inosinate, 5'- guanylate have flavour enhancing properties and also show a synergistic effect in the presence of glutamate. 5'- nucleotide can be produced by the degradation of ribonucleic acid.

Maltol – It is a different type of flavour enhancer, able to enhance the sweet property produced by sugar. Maltol is formed during roasting of malts, cocoa beans, coffee grains. During the baking process maltol is formed in the crust of bread. It is also found in many dairy products after heating of the products or decomposition. Formation of maltol is brought about at a high temperature and catalyzed by metals such as Fe, Ni and Ca. Due to antioxidant property maltol prolong the storage life of coffee and roasted cereal products. It is being used as flavour enhancer in chocolate, candies, ice cream, baked products, instant coffee and tea, liquors and flavourings in the concentration of 50- 250 ppm and is commercially produced by fermentation processed.

Factors Affecting Taste Threshold / Sensations

(1) Diseases: Disease and Accident may cause temporary/permanent loss or decrease or alteration of taste sensations. Irritating tongue of patient with X-rays or cobalt source reduced taste sensitivity to all tastes except sour.

(2) Effect of sleep and hunger: Lacking of sleep up to 72 hours does not affect salt and sweet thresholds but significantly increase sour threshold. Fasting from breakfast until 4:30p.m. have no effect on sensitivity. Sensitivity to 4 basic tastes is maximum at 11:30 a.m. It decreases significantly for about 1 hr. after meal, followed by an increase in 3-4 hr.The salt and sweet thresholds are not affected by lacking of sleep up to 72 hours but the sour threshold is increased significantly. Sensitivity to 4 basic tastes are maximum at 11:30 a.m. It decreases significantly for about 1 hr. after meal, followed by an increase in 3-4 hr. Fasting from breakfast until 4:30 p.m. have no effect on sensitivity.

(3) Age: New born to 40 days has no or little taste differentiation ability. Children of 7-11 year age possess less differential sensitivity. Higher sweet threshold was observed by 52 to 85 year group than 15 to 19 year. The people after 60-year age loss the taste sensation ability particularly for sweet & sour mainly due to degenerative changes in taste receptors whereas no change for salt & bitter.

(4) Smoking: Smoking has no effect on threshold for sweet, sour, salt except bitter as nicotine & other alkaloids present in smoke may fatigue the perception mechanism.

(5) Other factors: Chronic alcoholism, excessive smoking, allergy, hay fever, badly infected germs, marked tooth decay did not affect the sensitivity to sucrose.

(6) Effect of temperature on taste: Taste, temperature & pain are interrelated. The temperature of receptor is more important than temperature of sapid substance. Fluids of extreme cold temperature cause temporary insensitivity. So the sapid substance should be neither so cold nor so warm as it distract attention from the taste reaction. Optimum sensitivity to taste producing substance occurs at 30-40°C. Increasing temperature cause increase in response to sweet but decrease in response to salty & bitter. The acid taste sensitivity remains unchanged at increased temperature. The optimum temperature for sucrose & HCI is 35-50°C, but for salt and quinine are 18-35°C and 10°C, respectively. At 10°C NaCI at or near threshold concentration exhibit bitter taste.

(7) Effect of taste medium: The intensity of the taste is greater in aqueous media than in paraffin oil/mineral oil due to the combined effects of viscosity and solubility of the compounds in oil and of the oil in saliva.

(8) Chemical configuration/structure and taste: Chemical structure of a compound and taste are strongly interrelated. All acids are sour, NaCI and other salts are salty. Bitterness depends on atomic size, increasing in atomic size increases bitterness. Chemical specificity i.e. ortho, meta or para positions of different groups in a compound alter the tastes. Minor changes in the chemical structure may change the taste of a compound from sweet to bitter or tasteless. Stereo specificity, optical rotation (Levo or Dextro) etc. may also alter tastes.

Conclusion: Every food has characteristics and indices, measured by sensory, physical, chemical and microbiological methods. These characteristics represent the quality of food. People mainly accept food on the basis of certain characteristics which can be defined and perceived by their senses. These characteristics describe the sensory quality of food. The sensory qualities include perception of appearance factor like colour, size, shape and physical aspects; kinesthetic factors such as texture, viscosity, consistency; and flavour factor. Among them flavour plays a very important role. It is a sensation combining odour and taste. So understanding this flavour characteristics and familiar with the appropriate measuring tools are vital.

Suggested Readings

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